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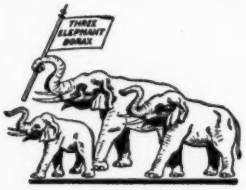

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R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXVIII NO. 4

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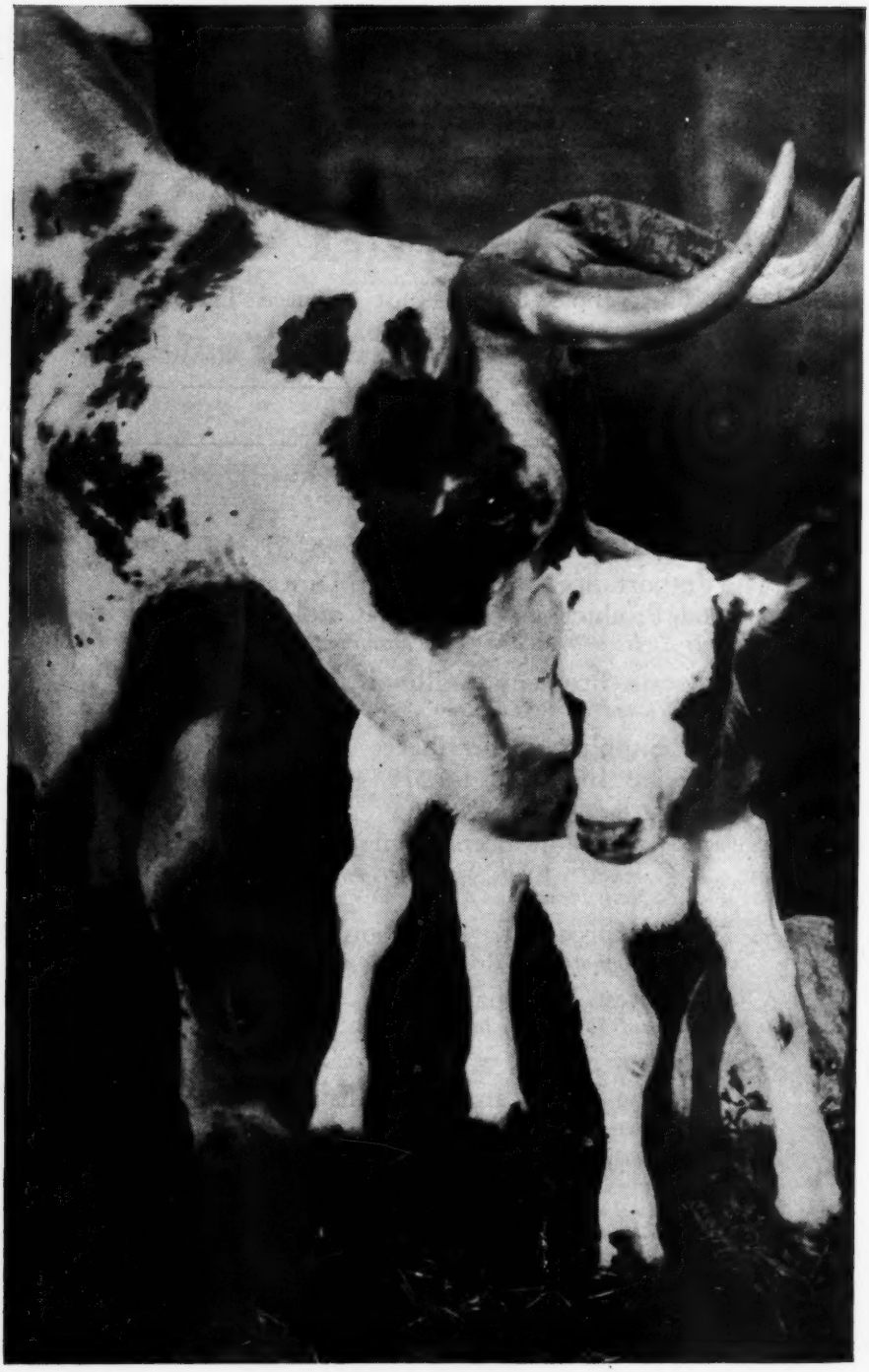

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VOL. XXVIII WASHINGTON, D. C., APRIL, 1944 No. 4

Agriculture has its

Bottlenecking

Jeff McDermid

AMERICAN terms shift with the scenery. When I was a callow youth eager to behold everything intended to be seen or otherwise, they called me a "rubberneck." It was a term meant to discourage unseemly stretching, which was frowned upon. Today things are sort of reversed. Folks glibly use the term "bottleneck" meant to deride all things that *won't* stretch, and then exert pressure from all quarters so they will. Rubbernecking is o. k. these days, but bottlenecking is a sin against convenience, custom, and necessity.

Strange to say, the farmer's craft, so free from tippling to drown wartime sorrows, is pestered with no end of plugged bottlenecks. He who would quaff and imbibe, gurgle and smack over the delights of acquiring tools, services, and equipment at a propitious time for cash transactions finds his thirst for production stoppered and blocked by sundry corks, plugs, and frozen materials.

Verily, the frustrated farmer is now in keen personal sympathy with the motherless calf on a skimpy skim-milk diet, the bawling infant with a full milk bottle without an exit, not to mention the fox who was invited to dine at the stork's from a narrow-necked flagon.

But farmers as a class are somewhat used to bottlenecks and perhaps regard them with more philosophy than the pampered pavement population. However that may be, it will never do for the rambunctious farm leadership to sit down calmly and tolerate a whole case full of bottles without clear necks to jam up the works. Hence you are going to witness more hellzapoppin for the dura-

tion than anything the champagne class can produce. In ordinary humdrum days your farm leader will accept and tolerate the usual run of bottlenecking, treating it with that fine sense of dignity and aloofness with which drouths, floods, and hailstorms are accepted as unavoidable bottlenecks to successful harvests.

Speaking first of the climate and its twin, the weather, these are the most ancient of bucolic bottlenecks. To all those whose zeal and the zodiac are inseparable and whose wagons are more or less tied to some star or cloud, the eternal ever-present bottleneck of Boreas is real, personal, and persistent.

I KNOW of no region save California where they won't admit it pronto. Out there the oranges always flower and fruit to perfection, the alfalfa luxuriates under irrigation without recourse to rains, and chambers of commerce brag loud enough to drown out sundry skeptics hidden among the sage brush. In my state we are partners with Pluvius and put the almanac under our pillows. Every time some loquacious government authority mentions goals and food records to be busted, our neighbors shift their cuds and reach for old Doc Biggers' advance predictions. Even the college-bred plowmen don't feel like starting the mower until they call up the U. S. Weather Bureau, and then they proceed with misgivings. Our weather holds the world record for quick changes—unseemly frosts on July peat lands where tubers grow and high temperature typhoons that curl corn leaves within a week after a deluge. About all we are sure of is the time the sun rises and sets and the phases of the moon. The rest is simon-pure guess work, with the food producer holding the hazards. Crop insurance won't relieve this bottleneck much either, because cows and chickens don't care for any metallic substitute for long green fodder. Livestock don't thrive on cash indemnities.

Next to, or rather co-partner with, the weather in vexing farmers with natural bottlenecks, are the divers pests, maladies, epidemics, and ornery interlopers which insist on sucking, biting, chewing, draining, blotching, shriveling, and destroying the fine things that might take prizes at the autumn pumpkin shows.

Most of these setbacks can be traced to weather vagaries, this year's or last year's, or maybe a lack of certain nasty smelling remedies and applications, sprays, douches, and nostrums which could have been used with some success if the planter had not been so busy watching the winds and the thermometer. How can you call it neglect when a man has only 24 hours in a day, no eyes in the back of his head, and a hired man with a 1-A appetite and a 4-F work capacity?

To make a farmer hopping mad is to deprive him of necessary fighting tools, with which to combat the aforesaid obnoxious devouring enemies. Here we had for a time one of the man-made bottlenecks which proved most annoying simply because the farmer did not know whom to blame—the factory, the war, or the OPA. If you can pause and cuss at a target, it helps some on mental marksmanship.

Among bucolic bottlenecks I would surely put all manner of factors which limit farm progress and profit and which to a great degree are traceable to the sloth or stubborn indifference of the rank and file.

THEY are the kind of bottlenecks that seldom get into the campaign oratory or fill the headlines of the sensational press. I have never seen a politician or a rabid organizer get his collar wilted or his voice worn out yelping at the yokels for neglecting their duty to mankind and themselves

by failure to adopt sensible modern methods.

All the yawping I have listened to was directed at forces and conditions outside the fence lines, mostly in some distant metropolis where malignant malefactors of great wealth and greed were plotting to overthrow and undermine, ravish and maim the innocent and toiling masses of the countryside.

I have never heard one of them take a swipe at inferior germ plasm, for instance, or washed-out, betrayed, and depleted land, or machinery rusting in the snow banks. No, it was only through the timid tenor of the circuit-riding extension evangelist, whose audience was usually the kind that needed no conversion or soul-saving sermons. The other kind stayed away and waited for the agitator and the technicolored thrillers. Bottlenecks lying around loose near home plate didn't count with them.

Probably inferior germ plasm of the barnyard variety has raised more sloping-rumped, nondescript, pot-bellied, razor-backed, rickety, grain-stealing soil robbers than any other form of bottleneck ever inflicted on agriculture. Right in the heaviest milk-producing states we have less than five per cent of the cows subjected to systematic testing; our breed clubs keep going in circles trading with each other and making fewer fresh recruits than the Salvation Army in Russia.

We have scads of simpletons investing in some jockey's "boarding bull" to keep him in fodder and furnishings until such time as he manages to cause the seasonal freshing of the feminine members of the herd, and then he gratefully returns the bovine behemoth to the original owner to be sold for ceiling prices in the sausage market. It's great for the wienerwurst business but tough on profitable milk production.

We have others who take kindly for awhile to the idea of using proven bulls for dam-daughter improvement purposes. But they forget or postpone paddock building, keep the old codger in the darkest den they can find in the basement, let his hoofs grow out like snowshoes, and finally have an accident or a funeral and quit trying to prove anything.

We have another half-educated and dangerous bunch who opine that this here cross-breeding of hogs is great ganders. So they get a half-breed boar and mate him successively with half-baked sows of all the colors of the rainbow, which to their thinking is surely cross-breeding, and then blame the result on Chester Bowles or Harry Hopkins.

This all goes to show something, mostly I presume that "a little learning is a dangerous thing" and what you don't do right yourself you can always blame on bureaucratic bottlenecks which an election will correct.

Having good livestock is one thing, and feeding it well is another. I want to drag in the mill feed and home-mixed ration bottleneck awhile to illustrate another mighty big point in my premise.

You know how it is, demonstrations on balanced rations have been going the rounds for over twenty years, and the state and federal governments have spent good tax money as well as special grants to keep the presses busy dishing up bulletins and yearbooks with all sorts of suggestions to fit almost every kind of farm. You

(*Turn to page* 51)

The Importance of Potash in Maintaining Food Production in N. C.

By Ralph W. Cummings

Head, Department of Agronomy, North Carolina Agricultural Experiment Station, Raleigh, North Carolina

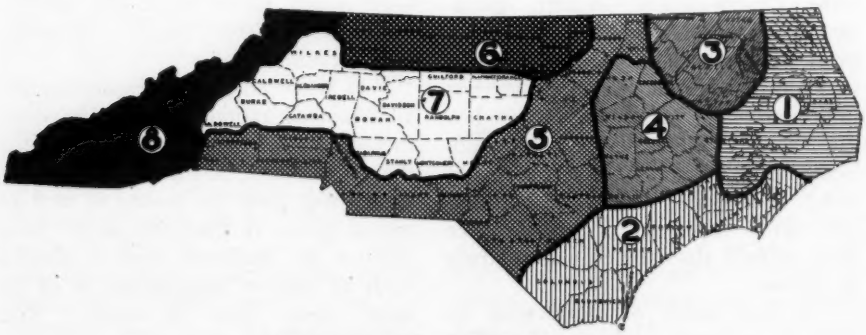
HOW much food will a ton of potash produce? And how can each ton of potash be used to produce the greatest amount of the kinds of food needed most? These are very vital questions at a time when the supplies of both food and potash are below those demanded by the consuming public. If the complete answers to these questions were available, the job of allocation of potash by government officials would be a much simpler one. Likewise, it would be much easier for government officials to decide on the relative priority to be given to expansion of facilities for refining potash salts.

Although the complete answer is not available, partial answers can be found in the data files and bulletins of the various agricultural experiment stations. Data from the North Carolina Experiment Station have been examined with this in view. The available potash content of North Carolina soils as determined on samples submitted to the Soil Testing Laboratory of the N. C. Department of Agriculture have been reported by J. F. Reed in an article in another issue of this journal. A summary of the data on crop responses follows in Table 1.

For this purpose, the State has been subdivided into eight agricultural areas as shown by the map. These areas are based on crop distribution as outlined in N. C. Agricultural Experiment Station bulletin No. 293. As indicated in this bulletin, the leading crops in each area in order of extent are:

Area No.	*Leading crops*
1	Corn, soybeans, cotton, Irish potatoes
2	Corn, cotton, vegetables, peanuts
3	Cotton, corn, peanuts, tobacco
4	Cotton, corn, tobacco
5	Cotton, corn, tobacco
6	Corn, tobacco, wheat
7	Corn, wheat, cotton
8	Corn, small grains, grasses, apples

Unfortunately, reliable potash re-



Agricultural areas of North Carolina

TABLE 1.—SUMMARY OF YIELD RESPONSE OF DIFFERENT CROPS FROM ONE TON OF K_2O IN VARIOUS AGRICULTURAL AREAS OF NORTH CAROLINA

Notes. These are taken from experimental plots and are indicative of trends. Insufficient locations are included to warrant the conclusion that they necessarily represent the areas adequately.

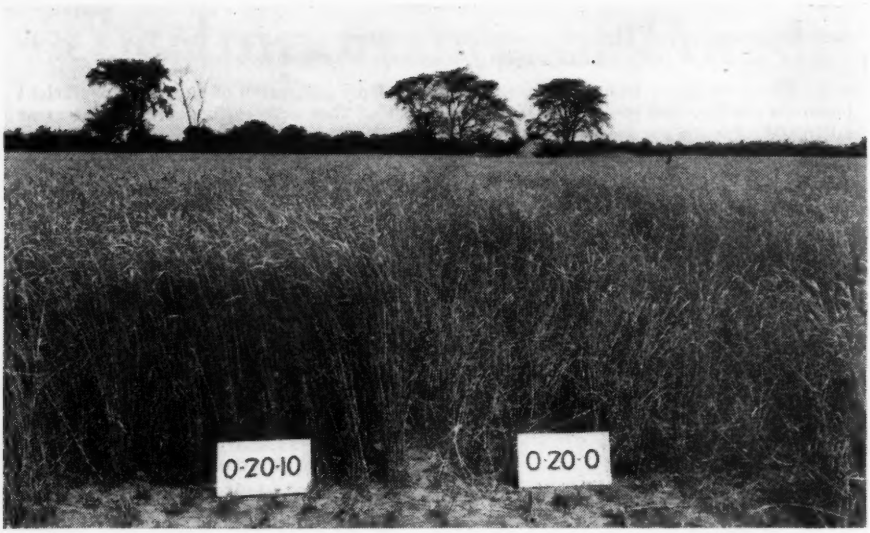
Agricultural area	Crop	No. of locations	Yield response to one ton K_2O
1	Irish potatoes	14	268 cwt.
	Sweet potatoes	5	873 cwt.
	Soybeans	1	455 bu.
2	Sweet potatoes	1	240 cwt.
	Soybeans	1	394 bu.
	Pastures	1	21.5 tons (dry forage)
3	Cotton	4	13,035 lbs.
	Peanuts	9*	4,500 lbs.
4	Cotton	2	11,860 lbs.
	Peanuts	9*	4,500 lbs.
	Sweet potatoes	1	696 cwt.
	Soybeans	1	117 bu.
	Pastures	1	24.1 tons (dry forage)
5	Cotton	4	4,640 lbs.
	Peanuts	9*	4,500 lbs.
6	.....	..	.....
7	Cotton	2	5,376 lbs.
	Sweet potatoes	2	390 cwt.
8	Pastures	2	9.6 tons (dry forage)

*No. of locations—sum of those in areas 3, 4, and 5.

sponse data are not available on all the leading crops in all areas. Experiments are under way or are being planned to fill as many as possible of the gaps. It will be noted that corn has been omitted from the table of crop response data, although this crop occupies by far the greatest acreage of any cultivated crop in the State. Very few data were available on direct responses of this crop to potash. A number of long-term experiments had been conducted on rotations including corn. In most cases, however, plots receiving no potash had been compared with those receiving small quantities of potash. Over a period of several years the potash supplies in the plots receiving none were severely depleted. It was felt that for the purpose of this study, such a comparison would give an exaggerated picture of the actual potash response.

For the relatively heavily fertilized crops, such as Irish potatoes, sweet potatoes, and cotton, data were taken only from rate of potash studies. Comparisons are made between applications of potash corresponding to experiment station recommendations and those somewhat less. In these cases no comparisons are made against plots which received no potash. This restriction on the data reported herein gives a conservative estimate of the potash responses. They are thought to indicate the amount of reduction in yield which would result from a lowering of the potash content of the fertilizer. Although the experiments were located on the important soil types of the respective agricultural areas, the number

(*Turn to page* 50)



Left: 160 lbs. 0-20-10; yield 29.6 bu.; test weight 54.5 lbs. Right: 150 lbs. 0-20-0; yield 13.7 bu.; test weight 45 lbs. Only 10 per cent extra potash made this extreme difference in strength of straw, total yield, and test weight per bushel. Poorland Farm, Salem, Ill.

The Potash Problem In Illinois[1]

By R. H. Bray

Department of Agronomy, University of Illinois, Urbana, Illinois

THE potash problem in Illinois has been of vital concern to me for the best part of the 21 years which I have spent studying the chemistry of Illinois soils and the relation of soil chemistry to crop production in the Corn Belt.

It was back in 1930 that I first started studying the chemistry of soil potassium with respect to soil fertility. This followed hard on the heels of the soil test for phosphorus, put out in 1929, which had already proved its worth in the solution of the phosphate problem that had become critical at that time. Perhaps most of you can recall the time when we were recommending that large amounts of phosphate be applied to soils as part of our management system. The soil experiment field results had told us that some soils responded to phosphate and some did not, but they could not tell us which particular farm soils needed phosphate and which did not. As a result, many farmers were not being benefited by applying phosphates.

Studies with the soil test showed that the lack of response was not because the phosphate being used was not a satisfactory phosphate, but because the soils which did not respond already contained sufficient amounts of available forms of phosphorus. The soil test for phosphorus readily picked out, with relatively few exceptions, the soils

[1] Paper presented to the Illinois Agricultural Association, Chicago, November 18, 1943.

which did not respond and put phosphate used on a practical footing. This test represented one of the first practical applications of soil chemistry to the solution of nutrient needs which could be applied to each individual farm soil and thus give specific recommendation to each farmer.

It appeared, therefore, that the thing to do about our potash problem was to find out about the chemistry of soil potash and crop production and then design a soil test which could accomplish the same results as had been accomplished by the acidity and phosphorus tests.

Now just what is the potash problem in Illinois? The simple facts of the case in 1930 were:

1. A large number of the Illinois experiment fields were giving good responses to added potash fertilizers.
2. These responses varied widely, with no two fields giving exactly the same response.
3. There was no practical way of answering the following questions for any particular 40-acre field:
4. a. Is this field potash-deficient?
   b. How deficient is it?
   c. How much muriate of potash is needed to overcome the deficiency?
   d. Will it pay to use potash?

In other words, we knew we had potash-deficient soils; we knew that most of them were in the tight clay region in southern Illinois; and we knew that even within the tight clay region not all the soils were deficient, or at least not to the same extent. We also knew that in the dark-colored prairie soils some few were deficient and more were becoming so. We could make generalized recommendations for areas generally low in available potassium which could be considered practical because they were the best we knew how to make at that time, but we could not make a sure-fire recommendation for any specific case. The farmers requiring 100 pounds of muriate of potash and those requiring only 50 pounds, or perhaps none at all, were receiving the same recommendation.

That was our potash problem in 1930.

In attacking this problem with soil chemistry, the first thing we did was to review the attacks made in the past.

Many years ago it had been theorized (not believed) that since nearly all Illinois soils contained large amounts of total potash, the return of potash-containing materials or fertilizers would not be necessary. It was theorized that perhaps the turning under of organic matter would make the large supply of soil potash sufficiently available. It is good science to theorize, but it is poor science to believe your theory without testing it. Testing this theory on the Illinois experiment fields over a period of 20 years had completely overthrown it. This theory has been discarded.

Another Theory

Another theory we had in the past was that soil fertility varied with the soil type and that if one knew the fertility requirements of one area of a given type, these requirements would hold for other areas of that type. It was hoped that, by putting experiment fields on different soil types, one could determine the deficiencies for the type and apply the findings to all the other areas of that type.

This theory worked out only slightly better. There are certain soil types which can be designated as generally, but not always, potash-deficient. The available potash level, as well as that of other nutrients, varies greatly within the type as well as between types and there was, at that time, no way of knowing whether or not the experiment field was located on an area which contained the available nutrients in the amounts found on most of the areas of that type.

This attack, therefore, did not solve the problem of applying the experiment field results to the particular soil being

Left: 80 lbs. 0-0-60. Right: no potash. Potash-fertilized corn was normal green, while the unfertilized rows had lower leaves with brown marginal firing and yellowish streaks between veins. R. L. Murray farm, Centralia, Ill.

farmed by John Doe. This soil type is of help in generalizing for large groups of farmers. What is best for a large group as a whole may not be best for the individual whose problems are strictly his own. For the individual, the soil type cannot be considered a fertility unit to be treated alike with limestone, potash, and phosphate.

Now, let us get back to soil chemistry. In the early 1850's, Thomas Way, an English soil chemist, found that soils adsorb potassium on the surface of the clay particles.[2] This is called the replaceable or exchangeable form. By 1930 this form was considered of importance in plant feeding, but it had not been proved that it was a direct measure of the potash requirement of a soil.

Our first attack at the problem was to study the replaceable potassium in the soils of our soil experiment fields.

We found that a good correlation was obtained between the amount of replaceable potassium in a soil and its need for potash. In general, soils containing less than 100 pounds per acre (2,000,000 pounds of soil) of replaceable potassium gave good responses to potash; soils testing between 100 and 150 pounds gave medium responses, mostly for corn and legumes; and soils between 150 and 200 pounds gave some response with corn but not with other crops.

In 1932, a soil test for replaceable potassium which gave the same results as the quantitative work was devised. This was adopted for extension use and was also applied to plant-tissue testing.[3]

However, it is what has been done with this test in the last year and a half that is the meat of this discussion. But before I get started on the meat course, I should rapidly mention the chemical studies of soil potash, made by the Soil Fertility Division of the Agronomy Department in the period since 1930, which help explain our new work.

We have studied the weathering of the potash minerals in the soil through all the stages of soil maturity represented in Illinois. We have found which potash minerals are of most importance. We have found that it is the weathering away of certain of these minerals which has caused our potash deficiencies. With the Geological Survey, we identified the most important potash mineral in Corn Belt soils and called it "illite", after the State of Illinois. We studied the adsorption of added potash by the colloidal clay minerals and its subsequent release to the plant when it was needed. We studied the rate of release of potash from the inside of the clay mineral to the available form; we studied the equilibrium between the replaceable potassium and the other replaceable bases and the influence of this on potassium availability. These and many other studies, includ-

[2] The Clay particles are very small, ranging from 1/25,000 of an inch down in size.

[3] See mimeo. AG 878, "Potassium, Phosphorus, and Other Tests for Illinois Soils," by R. H. Bray.

ing the analysis of the crops growing on these soils, form the background for the rest of my discussion.

Recently, I made a new study of the correlation of our potash test with crop growth. Following a method of interpretation suggested by the German scientists Mitscherlich and Baule back in the early 1920's, I soon found myself in the midst of a highly interesting set of conclusions. They were so startling that I could hardly believe them, and I spent the next six months or so trying to shoot them full of holes. Part of these conclusions could have been predicted from the work of these German scientists; others are conclusions which do not agree with their original interpretations, but which put the whole study on a highly practical basis. I found that the new conclusions were sound and that they in turn were upsetting some of our old ideas about soil fertility.

I will not attempt to give the scientific background for these conclusions. It will be published in the journals devoted to this purpose. Instead I am going to devote myself entirely to the practical use to which these conclusions can be put.

The Soil Test Value and the Per Cent Yield

Table 1, column 1, shows a set of soil-test values for available potassium.

Let us take the first value for potassium, which is 55 pounds per acre, or 55 pounds in 2,000,000 pounds of soil. In the next three columns we have the per cent yield obtainable for the major crops grown in Illinois. Corn and legumes can grow 53 per cent of a crop on a soil which contains only 55 pounds of available potassium.

Now, just what do I mean when I say that corn will produce only 53 per cent of a crop on a soil testing 55 pounds of replaceable or available potassium per acre? I mean that that land is now producing, or will produce, only 53 per cent of the crop which it could produce if adequate but economical amounts of potash were applied. I mean that the yield with adequate potash is a 100 per cent yield and that this 100 per cent yield is used as the base for all percentage calculations used in this method of soil-test interpretation.

Practically speaking, for most soils and conditions in the Corn Belt, it takes as much replaceable potassium (55 pounds) to produce a 53 per cent yield of corn on a clay pan soil, deficient in phosphorus and giving a low yield in bushels per acre, as it does to produce a 53 per cent yield on a well-drained, friable silt loam, not deficient in phosphorus and giving a relatively high yield in bushels per acre. It also takes as much replaceable potassium (236 pounds per acre) to produce a 100 per cent yield of corn on the clay pan soil as it does on the well-drained loam even though the actual 100 per cent ceiling yields may vary between the two soils by as much as 50 bushels of corn. This means that the soil requirement is not directly related to the crop requirement and that they are two distinctly different values. The soil requirement is similar for similar per cent yields as just illustrated and as shown in Table 1. However, the crop requirement in

TABLE 1.—POTASH—TABLE OF VALUES FOR THE CALCULATION OF CROP YIELDS AND CROP INCREASES.

Lbs. K/acre by test (available K)	Per cent yield*		
	Corn legumes	Soy-beans	Wheat**
55	53	65	79
73	63	77	87
95	74	85	96
109	79	89	98
127	84	94	100
150	90	98	
182	95	100	
236	100		

* $\frac{\text{yield without added } K_2O}{\text{yield where K is not deficient}} \times 100 =$ % yield or % K sufficiency.

** Oats and other small grains probably similar to wheat.

terms of pounds per acre varies with the magnitude of the crop in bushels per acre. It is the fact that the soil requirement is similar for the same per cent yield which makes our new interpretation possible.

Now, let us get back to our first example. A 55-pound test permits a 53 per cent corn yield. This means that the use of adequate potash will almost double the yield, bringing it up to a 100 per cent yield. In our method of calculation this is a 47 per cent increase in yield, that is, the increase in yield is 47 per cent of the 100 per cent yield. If, with adequate potash, the yield is restricted to 40 bushels of corn by a shortage of other nutrients, or by the physical nature of the soil, these 40 bushels are considered a 100 per cent yield just as truly as if better conditions had permitted a yield of 80 or 100 bushels as the 100 per cent yield.

What about crops other than corn? Do they have the same potassium requirement? The answer is no, in fact they vary considerably in their soil requirement for potassium as shown in Table 1. A soil which can produce a 53 per cent crop of corn can, from the same amount of soil potassium, produce a 79 per cent crop of wheat or a 65 per cent crop of soybeans.

Again, Table 1 shows that a soil containing 109 pounds of available potassium by test can produce a 79 per cent crop of corn (or legumes), an 89 per cent crop of soybeans, or a 98 per cent crop of wheat.

Now, what are the limitations to the practical application of these facts? Will the indicated increases always be obtained? The answer is yes, provided we apply our facts in the same way in which they were obtained. These results are based on the average yields for several seasons. Legumes for supplying nitrogen were grown in the rotation and crop residues were returned. This means that, for average conditions, the amount of rainfall and the nitrates supplied by the soil and the legumes have been adequate for all increases resulting from potash additions.

On the other hand, phosphorus may or may not be deficient. This will not interfere with the potash test interpretation. If, therefore, a 70 per cent potash sufficiency exists, the average yields in the future with adequate potash use will be 100 per cent, or 30 per cent higher than they would have been without potash, although the actual yields with or without potash will be relatively lower on the phosphorus-deficient soil.

Potash hunger manifests itself in the white fleckings on the margins of alfalfa leaves. Alfalfa is a heavy feeder on potash.

These facts were obtained on silt and clay loam soils similar in chemical nature to most of the soils of the Corn Belt. Sand soils, "slick spot" conditions, peats, mucks, and alkali spots represent further variations in soil conditions

and may require a slightly different interpretation. Except for such limitations, the results are applicable generally for Corn Belt conditions.

The Potash Requirement

How about the K_2O or potash requirement for these different levels of available potash? Table 2 gives the K_2O requirements for different crops for different test values.

TABLE 2.—POTASH—TABLE OF VALUES FOR THE CALCULATION OF THE K_2O ROTATION REQUIREMENT.

Lbs. K/acre by test (available K)	K_2O Requirement** yearly			*Rotation** Corn oats clover wheat 4 years
	Corn legumes	Soybeans	Wheat (oats)	
	Lbs./A	Lbs./A	Lbs./A	Lbs./A
55	72	44	28	200
73	65	37	20	170
95	56	28	12	136
109	50	23	.....	100
127	43	16	.....	86
150	34	.....	.....	68
182	22	.....	.....	44
236	.....	.....	.....	.....

* The sum of the yearly requirements for each crop in a rotation equals the rotation requirement. This column illustrates a 4-year rotation of corn, oats, clover, and wheat or 72+28+72+28=200 pounds of K_2O for the 55-pound test value to be applied over a period of 4 years.

** The potash content of a fertilizer is expressed as K_2O. For example, 88 pounds of muriate of potash (KCL containing 50% K_2O) will meet the requirement for 44 pounds of K_2O.

Corn, of course, has the highest requirement for added potash, compared to beans and wheat, just as it had the highest requirement for soil potash.

For any soil-test value the requirement given for any crop is not the requirement where that crop is the only crop in rotation which is to receive potash. If you want to get the full increase for corn on the 55-pound soil, you cannot except to get it by using 72 pounds of K_2O as muriate of potash on the corn crop alone and not treat the other crops in the rotation. The way to use Table 2 is to list the crops in your rotation, after each crop put its K_2O requirement, then add the requirements together to obtain the rotation requirement (see Table 2). The prospective increase in yield given in Table 1 is dependent on using the full rotation amount consistently over a period of years. Using less than the rotation amount will, of course, be just as profitable per unit of potash used, but it will not produce the full increase in yield which could be obtained. With potash supplies limited as they are today, we will have to be satisfied with using less than the rotation requirement. Biggest returns from potash use under war conditions will come from allocating relatively more potash to the soils testing low in potash, provided such soils are otherwise capable of producing satisfactory yields.

The last column in Table 2 illustrates the full rotation amount for each test value for a four-year rotation of corn, oats, wheat, and clover.

The Practical Application

Table 1 gives the per cent yield obtainable for several soil-test values for available potassium. From these values can be calculated the actual increase in yields which may be expected from the use of adequate amounts of potash fertilizer. If, for example, you have been obtaining yields of 30 bushels of corn per acre on a soil testing 95 pounds or 74 per cent sufficient in potash, i.e., it is giving a 74 per cent yield, then the use of adequate potash will increase the yield from 30 bushels (74 per cent) to about 40 bushels (100 per cent). According to Table 2, the K_2O requirement for corn for such a test value is 56 pounds of K_2O per acre. This means that an investment in 56 pounds of K_2O per acre should increase the average yields of corn on this soil by

about 10 bushels per acre. These are most of the facts necessary for the economic interpretation of the potash test. An estimate of probable crop values and the cost of the fertilizer are the additional facts necessary.

Table 3 illustrates the practical use of Tables 1 and 2. Here we have the soil-test value in column 1 and the per cent yield in column 2. Then for each soil-test value we have a series of different yield levels to fit different cases which represent the average yield of different farms in the past. Next comes the yield of corn expected when potash is used in the full amount required for a rotation, and next is the bushels increase. Last comes the K_2O requirement and the cost when applied as muriate of potash at current prices, figuring the K_2O at five cents per pound. A simple inspection should be ample to show whether or not potash use will be profitable. You do not know what corn may be worth next year, but you do have a general idea; you also know approximately what fertilizer prices will be. All that is left for you to do is pick out on this table the soil-test value for one of your own fields, select the approximate average yield in column 3 nearest to the yield which has been obtained on this field in the past, and reach your own decision as to whether or not you are interested in using potash.

I do not guarantee that you will get exactly this increase in yield for any one year, but unless the results from all 23 experiment fields in Illinois are not to be trusted, you should average approximately this increase over a period of years of consistent potash use. The yield level each year is controlled by

TABLE 3.—POTASH—TABLE OF ORIGINAL YIELDS, EXPECTED INCREASES, AND POTASH REQUIREMENTS FOR CORN ON SOILS VARYING IN AVAILABLE POTASSIUM*

Lbs. K/acre by test (available K)	Per cent yield	Farmer's average corn yield in past	Farmer's average corn yield in future	Bushels increase for potash use	K_2O requirement	Cost as KCl
					Lbs./A	
		25	47	22		
		30	57	27		
55	53	40	76	36	72	$3.60
		50	94	44		
		25	40	15		
		30	48	18		
73	63	40	63	23	65	$3.25
		60	95	35		
		25	34	9		
		30	40	10		
95	74	40	54	14	56	$2.80
		60	81	21		
		25	30	5		
		30	36	6		
127	84				43	$2.15
		50	60	10		
		70	83	13		
		25	28	3		
150	90	50	55	5	34	$1.70
		80	89	9		
		100	110	10		

* Where the full rotation requirement for K_2O is used and nitrogen is not seriously deficient.

climate, but even the climatic effect is averaged out over a period of years.

Now you can see that we are not ignoring the other nutrient deficiencies or the physical nature of the soil type. The farmer's average yield in the past is itself both a measure and a result of these deficiencies. Also, the final yield in column 4 of Table 3 is still not necessarily the maximum yield obtainable unless the base yield you select (column 3) was obtained when all other deficiencies except potash had been corrected. It is the maximum yield obtainable by adding only potash to the soil management program already in effect. I will not show the tables for legumes, soybeans, wheat, or oats. They illustrate the same thing which this table illustrates for corn.

Potash is absolutely necessary for profitable farming in most of the southern Illinois potash-deficient areas. This picture from the West Salem field tells its own story.

It has already been said that we can apply the potash test interpretation without knowing the phosphorus status of the soil. However, where phosphorus is also deficient, it is usually more practical to apply both at the same time. The potassium test is not the only test which can be interpreted in terms of per cent yield and nutrient needs. The new fluoride soil test for phosphorus (Method No. 2) published about two years ago* is also sufficiently accurate to be interpreted in exactly the same way as I have just interpreted the potassium test. The accuracy is not as high as in the case of the potassium test, which is our most accurate one, but it is still well within the practical range. As with the potassium test, the phosphorus test gives the per cent yield and the superphosphate or rock phosphate requirements.

Used along with the potassium test, a balanced fertilizer recommendation which recognizes each crop's individual need for each nutrient with respect to the soil level of these nutrients becomes possible. This does not mean that each crop in the rotation receives the same ratio fertilizer. The ratio used will depend on the relative needs of the different crops. Once the rotation requirements are known, the fertilizers can be applied according to our best knowledge of methods of fertilizer application, a subject which will not be taken up here.

Now, I should like to point out certain additional uses to which the soil-test values can be put. For example, suppose a farmer has only a limited amount of money to invest in fertilizers. Should he use adequate potash on two fields or adequate phosphate on two fields instead of applying both nutrients to one field? Should he add half the total requirement for both nutrients to two fields instead of the full amounts to one field?

Such problems are readily worked

* See mimeograph AG 1028, "Rapid Test for Measuring and Differentiating Between the Adsorbed and Acid-soluble Forms of Phosphate in Soils," by R. H. Bray.

TABLE 4.—POTASH—YIELD EXPECTATIONS AND ECONOMIC RETURNS FOR DIFFERENT METHODS OF TREATMENT ON A SOIL DEFICIENT IN BOTH P AND K BUT WHERE LEGUMES HAVE ALREADY BEEN USED.

Soil-test Values.....K test = 73 pounds
P test = low +

Crops in rotation	Past yields with no P or K	Full P and K requirement added	1/2 P and K requirement added	Full K requirement added	Full P requirement added
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Corn	33	63	53	55	38
Oats	27	39	35	33	31
Legume hay	(0.8 tons)	(1.8 tons)	(1.5 tons)	(1.3 tons)	(1.1 tons)
Wheat	17	29	25	21	24
Gross value of all increases (4 years)	None	$41.10	$27.40	$22.10	$13.80
Cost		$14.22	$ 7.11	$ 8.50	$ 5.72
Net		$26.88	$20.29	$13.60	$ 8.08

Values used—Wheat at $1.00, Oats at $0.30, Clover at $10.00, and Corn at $0.50.

out provided one has the potassium and phosphorus test values and a knowledge of the yields obtained in previous years.

Table 4 gives an example of a soil deficient in both phosphorus and potassium where legumes are grown in the rotation. The results from various treatments are calculated as shown in columns 2, 3, 4, 5, and 6. The gross value of the increases is shown and the

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Covered with "slick spots" the Newton field represents one of the poorest soils in southern Illinois. Potash increased corn yields from 29 bushels on the RLP plot to 47 bushels on the RLPK plot. (1939-42 average.)

Record Supplies of Fertilizer Materials Indicated for 1944-45*

By S. L. Clement

Deputy Chief, Fertilizer Materials Unit, War Production Board, Washington, D. C.

EVERYONE concerned with the production of food and fiber crops in 1944-45 to meet record requirements is interested in learning as early as possible the outlook for fertilizer supplies. Among the interested groups are the War Food Administration, the agronomists and other agricultural workers in the states, the members of the fertilizer industry, and the producers of farm commodities. As a guide to these groups the War Production Board has attempted to estimate the supply of each major fertilizer ingredient which will be available next year for agriculture in the United States, including Hawaii and Puerto Rico.

It should be emphasized, however, that any estimates made this far in advance, although based upon the most reliable information available, are subject to considerable error. Not only is it impossible to determine accurately what the domestic production of each material will be, but the quantities which will be imported are subject to considerable uncertainty and military requirements can only be estimated.

Potash

Potash perhaps is subject to less uncertainty than are most of the other fertilizer materials, the domestic production having become stabilized at a high level with the major producers operating 24 hours a day throughout the year. In 1943-44 the entire supply has come from domestic production and there is no assurance of any imports in 1944-45, although the possibility of obtaining shipments from Spain and Russia is being explored. In the current year out of a total production of 771,000 tons of K_2O approximately 100,000 tons were allocated to the chemical industry, a large part of the product going to meet direct or indirect military requirements. In the present estimate of supplies available for domestic fertilizer it is assumed that chemical requirements for potash will remain unchanged in 1944-45.

According to present indications United States agriculture (including Hawaii and Puerto Rico) will have available in 1944-45 approximately 700,000 tons of K_2O from primary potash salts, an increase of 96,000 tons of K_2O, or 16 per cent, over the 604,000 tons allocated in 1943-44. It appears that there will be an increase of approximately 104,500 tons of K_2O in the form of high-grade muriate, while the supplies of 50 per cent muriate and manure salts will be reduced approximately 2,500 tons and 10,000 tons, respectively, of K_2O. Sulphate of potash is expected to increase by approximately 4,000 tons of K_2O and the supply of sulphate of potash-magnesia will remain practically unchanged. Although it will vary for different salts, there will be approximately the same quantity K_2O allo-

* Estimates of supplies are based largely upon data presented at fertilizer grade conferences held within recent weeks at various points throughout the United States.

cated in Period Four (June 1, 1944, through March 31, 1945) as was allocated in Periods Two and Three combined.

This anticipated increase in the supply of potash for agriculture is based on increased production capacity, elimination of lend-lease requirements, and more efficient utilization of existing production facilities. Plant expansion by one of the producers, already authorized by the War Production Board, is expected to provide 36,000 tons of K_2O in the last three quarters of the fertilizer year; approximately 20,000 tons exported under lend-lease in the current year are expected to be available for domestic use in 1944-45; and increased efficiency of production is expected to provide an increase of approximately 40,000 tons in production.

The increased efficiency of production had become evident by the beginning of 1944 and was one of the two factors which made it possible to increase Period Three (April and May 1944) allocations above the quantity which it previously had been estimated would be available for allocation. The other factor was the fact that the United Kingdom did not require delivery of the entire 36,000 tons of K_2O originally earmarked for lend-lease. Only 20,000 tons were taken, the remaining 16,000 tons becoming available for domestic use.

In estimating the portion of the total domestic production of potash which will be available for agriculture, it is assumed that the requirements for industrial chemical uses will continue at the all-time high level reached in 1943-44, when the quantity allocated for these uses was approximately 100,000 tons of K_2O. If these requirements, a large part of which are for military purposes, should decline, the supply for agriculture will increase proportionately. It is also assumed that potash exports to countries other than the United Kingdom will be no larger than the quantities already approved.

Superphosphate

The 1943-44 superphosphate program calls for a production of 7,000,000 tons of normal superphosphate, basis 18% P_2O_5, with an annual rate of production of 8,000,000 tons by the end of June. Present indications are that the actual production will fall little, if any, short of the 7,000,000 ton goal. Production during the first eight months of the year amounted to approximately 4,494,000 tons, February production amounting to 614,115 tons. It is expected that the output will be stepped up considerably during April, May, and June, after the peak of the fertilizer mixing season has passed. If we assume an average of 620,000 tons for the five months beginning with March, the total production for the year will be approximately 7,000,000 tons.

Heretofore, shortage of sulphuric acid has been the most serious obstacle in production, but apparently labor has now become the most serious limiting factor. The movement of acid from Ordnance plants for superphosphate reached a record quantity in March, amounting to approximately 40,000 tons, basis 60° Baumé. In the Southeast there was more acid available to acidulators than they were able to use because of the lack of sufficient labor to mix and ship fertilizer and at the same time maintain full production of superphosphate plants. In view of this situation, the output of Ordnance plants in that area was curtailed somewhat in April.

In order to raise the annual production rate of superphosphate to 8,000,000 tons, it was necessary to construct some additional facilities for both superphosphate and for sulphuric acid in certain areas not adequately provided for at present. New acidulating facilities with an annual production capacity of approximately 612,000 tons of superphosphate, basis 18% P_2O_5, have been approved and construction will be completed by the end of 1944. Approxi-

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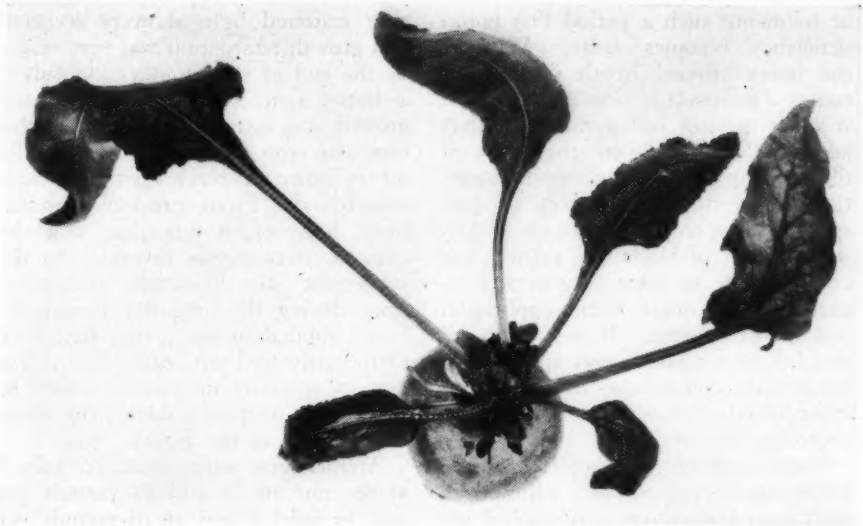

Fig. 1. An extreme case of boron deficiency. Cross hatching is evident on the leaves which were well developed when the deficiency became acute. Progressive stunting and dying of embryonic leaves resulted in the characteristic rosette in the crown.

Borax Sprayed on Beets Controls Black Spot

By J. C. Walker, W. T. Schroeder, and J. E. Kuntz

Agricultural Experiment Station, University of Wisconsin, Madison, Wisconsin

A CONSIDERABLE acreage of garden beet is grown annually in the truck crop area of eastern Racine and Kenosha Counties in southeastern Wisconsin. The best crops are produced in the old glacial-lake-bottom area between the cities of Racine and Kenosha. This soil is level in topography, well-tiled, and kept at a very high fertility level with the production of onion, cabbage, potato, tomato, beet and carrot in rotation.

In 1942 most fields in this area showed varying amounts of internal black spot in spite of the fact that liberal amounts of borax (50 lbs. per acre or more) were applied broadcast with the fertilizer before sowing. Some of the fields in question were rejected by one canning company because of black spot.

In previous reports (1, 2, 3) it has been shown that more often than not a small amount of black spot is observed when beets grown on boron-deficient soil are examined critically, even though relatively large applications of borax are applied either broadcast or in bands along the row. Mid-season spraying also has been shown to correct internal black spot when applied to beets on boron-deficient soil (2, 3).

Canning beets are sown early in the area mentioned and with favorable rainfall produce heavily. It is not uncommon, however, for a mid-season drought to occur in this region where the cool air of Lake Michigan tends to deflect thunder showers. It is during

or following such a period that boron deficiency becomes acute. Whether the borax applied in the spring becomes temporarily unavailable or whether the low soil moisture inhibits adequate absorption by the roots of the growing plants is not a settled question. Nevertheless, growers of prospective large crops of beets are in constant danger of black spot ruining the crop in spite of what is generally regarded as adequate borax application just before sowing. It was therefore decided to try mid-season spraying of borax on a commercial scale to determine whether this was a worthwhile protective measure.

Borax solution was applied with a 6-row sprayer, 2 nozzles adjusted to each row; 150 gallons were applied per acre at 450 pounds pressure. Several fields were treated. Results from two of these will be given in detail.

Both fields were fall-plowed; 1,500 lbs. of 3-12-12 containing 75 lbs. of borax were applied per acre and disked into the soil thoroughly just prior to sowing. Field 1 was sown with Asgrow Canner on April 23; field 2 with Detroit Dark Red on May 1. Heavy spring rains produced an abundance of top growth. Throughout June only scattered light showers occurred and growth retardation was very severe by the end of the month. On July 5 a heavy rain fell (1.65 inches) and growth was again accelerated. At this time the crop was examined carefully for evidence of black spot and none was found. From previous observations, however, it was clear that the climatic picture was favorable to development of deficiency symptoms, since during the long dry period the borax applied in the spring had been temporarily tied up, while the recent rain by speeding up growth would be expected to increase suddenly the boron requirement of the plants.

Applications were made on July 8 at the rate of 10 and 20 pounds per acre in field 1 and at 20 pounds per acre in field 2. Three replicates of each treatment were made with untreated strips between each replicate. One month later (Aug. 7) the treated plots in field 1 were given a second spray and a new set of three replicates were treated with 20 pounds per acre for the first time on that date.

Harvest notes were taken in field 1 on Sept. 6 and 7 and in field 2 on Sept. 17. Five paired samples of 50 plants each were taken from the two center

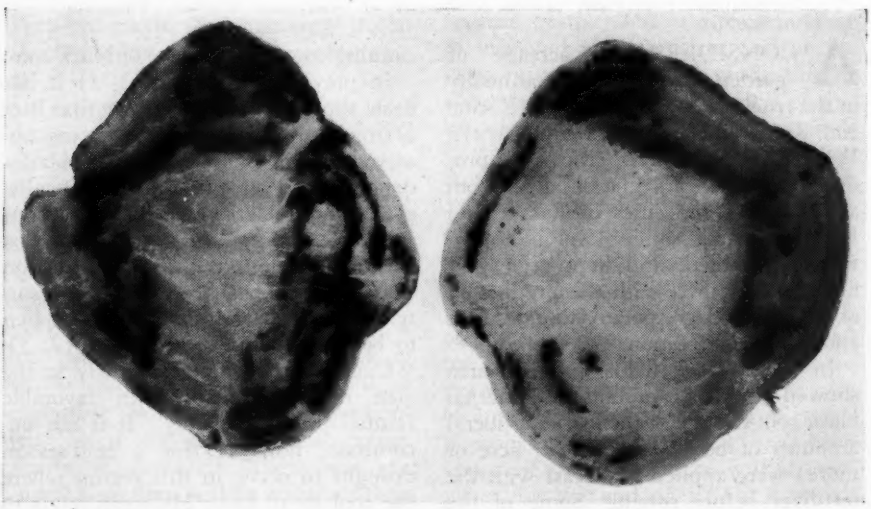

Fig. 2. Extreme boron deficiency in beet root which results when prolonged chronic deficiency of boron has occurred. (Compare with Fig. 3)

Fig. 3. Late-season boron deficiency confined to the outer tertiary rings of the beet root. This type of symptom was the most common in the cases described in this article. Acute boron deficiency occurred after midseason when the outer rings of nearly mature beets were most active in growth. Presumably the acute deficiency was brought about by temporary locking up of boron in the soil, since 75 lbs. of borax per acre had been applied when the crop was sown.

rows of each replicate of each treatment. The roots were cut in thin slices and the percentage showing any sign of black spot (total black spot) and the percentage severely affected (severe black spot) recorded. The results are presented in table 1.

It will be seen that in the untreated checks in field 1 from 37 to 43 per cent of the plants were diseased and from 14 to 23 per cent severely so. The 10- and 20-pound treatments on July 8 and Aug. 7 reduced the severely dis-

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TABLE 1.—THE EFFECT OF MID-SEASON SPRAYING WITH BORAX ON THE OCCURRENCE OF INTERNAL BLACK SPOT IN CANNING BEETS

Field No.	Pounds of borax sprayed per acre per treatment	No. of treatments	Date of treatments	Percentage black spot	
				Total	Severe
1	10	2	July 8 and August 7	16.1*	6.1*
1	None			42.5*	23.1*
1	20	2	July 8 and August 7	8.1*	2.4*
1	None			43.5*	20.6*
1	20	1	August 7	31.2	14.8
1	None			37.1	14.0
2	20	1	July 8	2.0* 8.2*	0.4* 3.6*

* Differences between treated and corresponding check are highly significant at the 1% level.

Austrian winter peas planted in a cotton patch keeps this soil working toward the maintenance of its fertility.

A New Approach to Extension Work

By P. O. Davis

Director of Agricultural Extension Service, Alabama Polytechnic Institute, Auburn, Alabama

GO wherever you may and talk with a farmer who is improving his operations, the odds are ten to one that it won't be long until he'll soon refer to something that "my county agent told me to do." If you happen to talk with his wife, the odds are that she'll soon refer to her home demonstrtaion agent in the same way. They are more than personalities; they are symbols of better farming and better living in farm homes in Alabama, in every state.

All of this is indeed remarkable when we remind ourselves that the great county agency system of this country is just now well started on its second quarter of its first century. In fact there are now in active service county agents and home agents who were pioneers in the work.

To contact people they walked, rode horseback or in buggies, and some actually traveled on bicycles. They saw and talked with as many people as they could, probably not realizing that they were pioneering in a service for better things and bigger service to follow. They had accepted a call to carry the torch in a changed agriculture, the foundation of the old being threatened by the boll-weevil. Their assignment was to preserve and improve as much as they could of the cotton industry and, at the same time, point the way to other crops and live-

stock to balance and improve what was then, and is now, an unbalanced agriculture.

Those pioneer workers were poorly paid missionaries for a great cause. They had either no or poor offices, no clerical assistance, no typewriter, and little other office equipment. Their influence was little; and there were misgivings about them.

An early tool with them was the demonstration, usually a few rows of corn or some other crop to teach facts about fertilizer, varieties, etc. The picture of a good farm managed by a good farmer living in a good home had not unfolded itself to them. They were dealing with small parts of farming, not the whole. Complete, or unit, farm and home demonstrations as we now see and use them were not in their procedure. Perhaps they didn't visualize them. Our use of them is a result of growth and improvement along with enlarged responsibilities.

While the county agents were working with men and boys, the home agents were working with equal ability and diligence with women and girls. Both were giving attention to 4-H club work which, from the beginning, has been a big and important part of the Extension Service program of which county and home agents are both symbols and leaders.

Experimental information, too, was inadequate in those days. Much has been accumulated but much of the research information now in daily use was then either in the laboratory or still in the process of being perfected for practical use and better results.

Time passed, new problems arose, bigger challenges were presented, more work was expected, and the personnel expanded. In 1933 new and bigger demands were presented extension workers by new agricultural programs aimed first at relief. Extension workers had guided farmers to the production of burdensome surpluses of cotton and other products. People and institutions were hungry and bankrupt and in distress while warehouses, granaries, and storage bins were overflowing with food and fiber from American farms.

This resulted in an agricultural control program, a program to adjust pro-

Livestock that are gathering their feed by grazing are doing work that otherwise man would be required to do

duction to market needs, the agricultural adjustment program in which extension workers have had big responsibilities from the beginning. Adjustments soon became combined with prices of farm products on which our position is well known.

These additional duties for extension workers called for better offices, adequate clerical help, modern equipment, telephones, and ability to guide and manage collective programs for all the farm people of a county, of a state, and of the nation.

I am merely mentioning these as milestones in our growth and service.

Corn with and without legumes on the Tennessee Valley Substation, Belle Mina. Yields on these plots were 20 bushels per acre without legumes and 40 bushels per acre with legumes.

They have brought us to where our minimum personnel in an Alabama county now consists of a county agent, a home agent, an assistant county agent, and a secretary. In addition, there are assistant home agents in 25 counties and labor assistants in most counties. There are also those who are engaged in our cooperative program in the TVA area and our timber marketing work in cooperation with the U. S. Forestry Service. To these we add Negro county and home agents in 40 counties, plus the staff at Tuskegee Institute.

Closely cooperating with us are the AAA and the SCS workers, teachers of vocational agriculture, the State Department of Agriculture, chambers of commerce, and other business groups on both state and local levels—all working together, in the same direction, toward the same goals.

County extension workers have come out of attics and basements in courthouses. They are on the first floor and in the front rooms. Their offices are modern, their equipment generally adequate, their procedure efficient. They are leaders in the march of progress, and they are so recognized and appreciated. This is reflected by the esteem and the confidence in which they are held by the men, women, boys, and girls on the farms and the high esteem in which they are held by non-farm people, many of whom appreciate their dependence upon agriculture.

Instead of being weak voices crying in the wilderness, county extension

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Our Greatest National Asset

By Marvin Jones
War Food Administrator, Washington, D. C.

ONE of the greatest contributions that this Nation has been able to make to our fighting Allies has been food. Without the food that we were able to furnish, gallant old England might not have survived during the dark days when she stood practically alone between civilization and organized destruction.

A short while ago a Russian general who fought in the Battle of Stalingrad told me that but for the food and supplies America made available for the heroic Red Army, the advance could not have been carried out as it was.

Without our rich soils that food could not have been produced.

The capital stock of a nation is its soil resources. No business can stand a continuing drain on its capital; likewise no nation can endure long excessive drains on its capital resources.

We were able to furnish this food because we had a vast, new country, rich in natural wealth.

What are soil resources? They are food and clothing locked up in nature's warehouse against the time when man, through his efforts, takes them out. Our great soil resources in this country have enabled us to develop a great race of people. History shows that the character and strength of a nation goes up and down with its soil.

In our fast development of this new country we have not always been careful in the preservation of our soil, and much of this valuable Godgiven birthright has been permitted to wash or blow away. We have cut down our timber on the watersheds and hillsides; and the rains have descended, and the floods have come and beat upon the soil, carrying it into the branches and streams and on to the sea where it is lost forever. There are only a few inches of topsoil on which we must depend not only now but so long as we remain a nation. Man's destiny is linked to the soil. From it he came and to it he must return. From it he must draw his sustenance.

We stand aghast before the spectacle of destruction in so much of the war-weary world today — the devastated fields and gutted homes, the ruins of great cities now rubble and ashes and bones. But all this wreckage, even in the scorched earth areas, can be rebuilt with time and work. North Africa is already able to produce most of its food demands. Well-directed efforts can restore production in the stricken areas. I do not minimize the destruction; but restoration can be rapid.

Most Ruinous Nation

I am here concerned with an even greater destruction, of our own fields —not by the Nazi or the Jap, but a destruction of which we ourselves have been guilty, with our eyes open, our own hands stained with the dust and mud of our eroded soil.

According to H. H. Bennett, Chief of the Soil Conservation Service, we have ruined more land in less time than any other nation in history. More than 50 million acres of land in the United States, once cultivated, no

longer produce crops. That is nearly as much as our entire wheat acreage last year. And the best topsoil has been washed away from an additional crop acreage twice as large as that. Fortunately, we are learning of this danger before it is too late.

To win the war, and in the quickest possible time, is rightly our first determination now. That accomplished, our next aim is to establish a peace which will mean security, jobs and food. But we must give especial thought to the basis of all these things —our natural resources upon which they depend, and without which our victory in war would be a useless thing.

Our Hope for the Future

A master plan for the land, upon which all other plans in the last analysis depend, is the place to start. Everything we hope for after the war, if that hope is to endure, is based upon the land. History has shown that where the soil and water resources have been guarded, nations have survived. Centuries ago the Tigres and the Euphrates Valleys were productive, and excavation and other records indicate the great civilizations which developed there.

Today our Mississippi Valley, and I mean by that the whole great area between the Alleghenies and the Rockies, is the greatest potential food-producing area in the world. Properly used and preserved it can, for centuries to come, not only supply abundance for our own people, but can help supply others with its products and bring back in trade additional goods for us to use and enjoy.

This great valley is full of abundance and plenty. We have the opportunity to use these resources fully and yet preserve them—or to use them fully and waste them. There is always a conservation use and wasteful use. In the past we have exploited our good earth with a prodigal disregard of its real value to our enduring life as a nation. We have sent the export crops down to the sea in ships and the soil down to the sea in mud. When the Mississippi overflowed at its mouth, we built levees. We tried to reverse nature, and when nature rebelled, as she always does, against such treatment, we built higher levees. We wasted both soil and water. Instead of using the water to our advantage, we tried to get it into the sea as fast as we could.

We have now learned that the wise way is to go back up where the water falls as rain and work with nature instead of against her; to utilize water at the source and thus treat it as a blessing instead of a curse. Whatever system will retain that water and soil is worth any national effort, however great. Out in the dry country not a gallon of water should be permitted to reach the sea. All should be used on the land. In other areas where it is abundant, it can be channeled and utilized for power, for additional wealth.

After the war our available manpower will eagerly turn from destruction in war to construction in peace; our engineering and technical genius and skills will turn from their prodigious feats throughout the jungles and deserts of the world in making war to the constructive challenge that awaits them here.

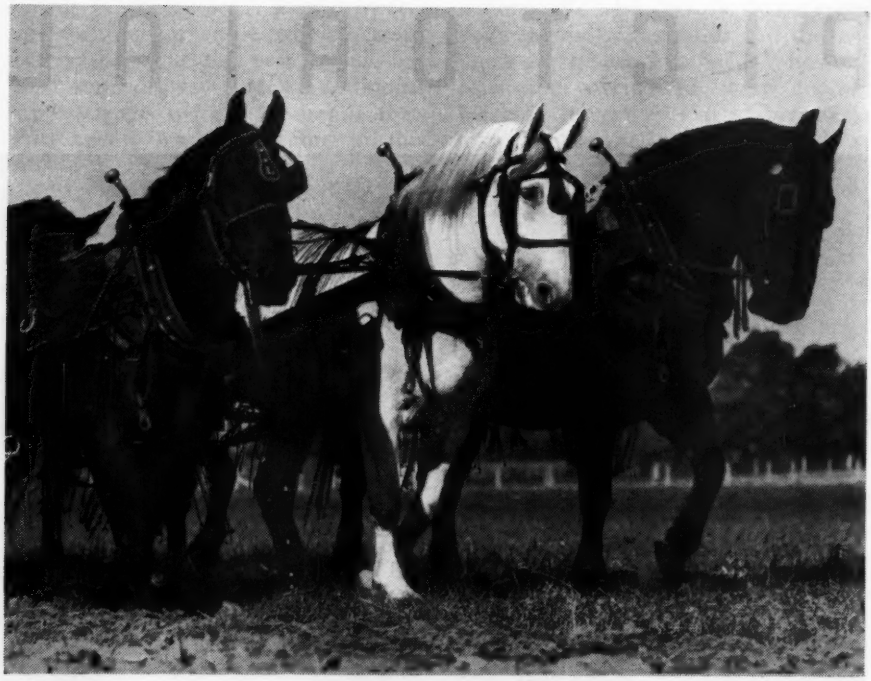
It is not for me here to spell out the technical blueprint of how this may be done. We have, fortunately, in this country those who have proven in this war that they are able to carry out any task, however big the job may be. Once made aware of the challenge, the genius of America will meet it without any specific directions from me.

We now know better than any other people have ever known how to conserve our soil resources. Great progress has been made. The Congress, with farsighted vision, has established a Soil Conservation Service and made provisions for carrying out an extended program of preserving our greatest na-

(*Turn to page* 48)

PICTORIAL

PALS!



HORSE POWER

OTHER POWER

GAMES—IN SEASON

The Editors Talk

Agriculture Post-war

Owing to the uncontrollable factors of time and seasonal requirements in the production of agricultural products, plans for agriculture must necessarily be made a considerable time in advance. It is thus necessary, even in the midst of the greatest agricultural war effort in the history of the country, to give consideration to plans for agriculture during the post-war period. A committee of scientific experts of the U. S. Department of Agriculture, calling on the vast resources of the organization they represent, has drawn up an analysis of the probable crop and livestock situation and agricultural conditions that are likely to be found as the end of the war approaches, and has sought to assay how these are likely to fit into post-war requirements. This has been published as a mimeographed pamphlet of the United States Department of Agriculture under the title "Agriculture When the War Ends." This is worthy of serious consideration by all dealing directly with agriculture, and should not be neglected by those dealing with general national problems because of the far-reaching influence of agriculture on the national economy.

When the war ends, it will find the nation's agriculture geared to a maximum effort. Whether this will result in maximum production will be dependent on such factors as weather, the condition of the agricultural plant as a whole, and labor and material supplies. If the war should be prolonged for a period of years, the general agricultural plant may have suffered serious deterioration, although at present it would appear as though the war effort has not made any great inroads. Total food requirements are likely to remain high and even to continue to increase somewhat until after a full year of harvest in the re-conquered European countries. The requirements for 1944 will range up to 150 per cent of 1943 production. If it were not for rationing and similar controls, requirements to meet demand would be even higher. Thus agriculture would appear to have an assured outlet for maximum production for the next two years at least. Increases will be desired in practically all vegetable and food crops. Maximum demands will be made on the oil crops such as soybeans, peanuts, flax-seed and cotton-seed, but continued increases in the production of these crops are being faced with difficult problems of suitable areas and labor and machinery requirements for production. The industrial crops such as cotton and tobacco present additional problems. Increased production of the longer staple cotton is desired, but milling capacities will tend to limit the amount of this crop that can be utilized and thus tend to discourage undue expansion. The demands of the food crops also will compete for land areas. The case of tobacco is even more of a problem. For the most part this crop plays only an indirect role in the war effort. With the exception of a small portion needed for the production of insecticides and similar material, the value of the crop in terms of war effort is limited to morale effects. Consumption is increasing and probably is greater than production. The competition of this crop for land areas is great in some sections, but is not serious in others where

soils desirable for tobacco production are too low in fertility to be very suitable for many of the food crops. The crop does make a considerable demand on labor, materials, and equipment.

Livestock production poses many difficult problems. The livestock population at present would appear to be larger than feed production capacities under existing conditions can support for any great length of time. The question as to whether it is more efficient to produce livestock or to put more effort into the direct production of food crops which might be substituted for livestock in the overall picture of human nutrition is continually arising. There are, of course, large areas of land suitable for the production of livestock that could not be well utilized for direct food production.

Our land resources apparently have not been seriously depleted by the war. Owing to the efficient work of the Soil Conservation Service for a number of years prior to the outbreak of the war, the soils of the country were in better condition than they otherwise would have been. In spite of this excellent work, the country is not on a sustaining basis and is continually drawing on the capital or reserve fertility of its soils, although at a much slower rate than would be the case without Soil Conservation measures. If the war is continued for a number of years, this factor may become much more serious than it is at present. The Committee calls attention to the necessity for carefully appraising the adaptations of soils and using them in the most efficient manner possible. Careful farming practices, improved soil management, and the use of fertilizers, liming materials, and other soil amendments are of great value and undeniable necessities from the national viewpoint.

Attention is called by the Committee to the serious situation existing with reference to our forest resources. Insufficient concern appears to be given to maintaining these resources, and the war effort is making inroads into them to the point that the future well-being of the nation may be seriously affected.

The physical plant of agriculture, such as buildings and machinery, is being gradually depleted, although efficiency has not yet been seriously impaired. The greater availability of implements, while not sufficient to meet demand, is helping the situation to some extent. Greatly aiding in the efficiency of agricultural production are new developments in the handling and processing of food, the development of higher-yielding strains and varieties of crops, better control of insects and diseases, improved usage of fertilizer, and better livestock feeding and breeding practices.

The financial condition of agriculture is good and, in general, healthy. Agricultural indebtedness is being reduced at a rapid rate, although a tendency for a rather rapid increase in land values and accelerated change of ownership of land is causing some concern. In the post-war period, sociological as well as economic problems will have to be given careful consideration if agriculture is to be kept on an even keel.

FARMERS and the people of the country need not repeat the experiences of the 1929 crash and the depression that followed. Production is going up and we need to keep it up after the present emergency is over. Our biggest job is to distribute and consume what we are able to produce. In this field we still have much to learn. It would be suicide not to prepare for larger consumption so we can make more effective use of our productive resources. Intelligent planning and positive action now will build a stronger America.—ROY F. HENDRICKSON.

Farm Prices of Farm Products*

	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
1910–14 Average	12.4	10.4	69.6	87.6	64.8	88.0	11.94	21.59	....
1920	32.1	17.3	249.5	175.7	144.2	224.1	21.26	51.73	....
1921	12.3	19.5	103.8	118.7	58.7	119.0	12.96	22.18	....
1922	18.9	22.8	96.7	104.8	58.5	103.2	11.68	35.04	...
1923	26.7	19.0	84.1	104.4	80.1	98.9	12.29	43.69	....
1924	27.6	19.0	87.0	137.0	91.2	110.5	13.28	38.34	....
1925	22.1	16.8	113.9	171.6	99.9	151.0	12.54	35.07	....
1926	15.1	17.9	185.7	156.3	69.9	135.1	13.06	27.20	....
1927	15.9	20.7	132.3	114.0	78.8	120.5	12.00	28.56	....
1928	18.6	20.0	82.9	112.3	89.1	113.4	10.63	37.70	....
1929	17.7	18.6	93.7	118.4	87.6	102.7	11.56	34.98	....
1930	12.4	12.9	124.4	115.8	78.0	80.9	11.31	26.25	....
1931	7.6	8.2	72.7	92.9	49.8	48.8	9.76	17.04	....
1932	5.8	10.5	43.3	57.2	28.1	38.8	7.53	9.74	....
1933	8.1	12.9	66.0	59.4	36.5	58.1	6.81	12.32	....
1934	12.0	17.1	68.0	79.1	61.3	79.8	10.67	26.12	....
1935	11.6	16.1	49.4	73.9	77.4	86.4	10.57	35.56	....
1936	11.7	17.2	99.6	85.3	76.7	96.0	8.93	31.78	....
1937	11.1	19.9	88.3	91.8	94.8	107.1	10.36	30.24	....
1938	8.3	17.2	55.5	76.9	49.0	66.1	7.55	21.13	....
1939	8.7	13.6	68.1	75.4	47.6	63.6	6.95	22.17	....
1940	9.6	15.1	70.7	85.2	59.0	73.9	7.62	24.31	....
1941	13.3	19.1	64.6	94.4	64.3	84.0	8.10	35.04	....
1942	18.51	28.3	110.0	108.3	79.5	101.8	10.05	44.42	....
1943									
March	19.91	16.0	145.1	153.6	94.8	122.7	12.28	45.73	....
April	20.13	16.0	166.8	179.2	100.2	122.3	12.61	45.89	....
May	20.09	37.6	190.7	225.1	103.4	122.8	12.66	46.11	....
June	19.96	57.0	188.0	222.0	106.0	124.0	12.20	46.40	....
July	19.60	59.0	167.0	267.0	108.0	126.0	11.90	44.50	....
August	19.81	38.4	159.0	276.0	109.0	127.0	12.20	50.90	....
September	20.20	37.2	134.0	231.0	109.0	130.0	12.90	51.90	....
October	20.28	41.8	128.0	196.0	107.0	135.0	13.70	52.50	....
November	19.40	44.5	133.0	177.0	105.0	137.0	14.50	52.50	....
December	19.85	42.4	135.0	188.0	111.0	143.0	15.20	52.60	....
1944									
January	20.15	41.5	141.0	202.0	113.0	146.0	15.70	52.80	....
February	19.93	25.1	139.0	211.0	113.0	146.0	15.90	52.60	....
March	19.97	21.9	137.0	220.0	114.0	146.0	16.00	52.70	....
Index Numbers (1910-14 = 100)									
1920	259	166	358	201	223	255	178	240	....
1921	99	187	149	136	91	135	109	103	....
1922	152	219	139	120	90	117	98	162	....
1923	215	183	121	119	124	112	103	202	....
1924	223	183	125	156	141	126	111	177	150
1925	178	161	164	196	154	172	105	162	153
1926	122	172	267	178	108	154	109	126	143
1927	128	199	190	130	122	137	101	132	121
1928	150	192	119	128	138	129	89	175	159
1929	143	179	135	135	135	117	97	162	149
1930	100	124	179	132	120	92	95	122	140
1931	61	79	104	106	77	55	82	79	117
1932	47	101	62	65	43	44	63	45	102
1933	65	124	95	68	56	66	57	57	105
1934	97	164	98	90	95	91	89	121	104
1935	94	155	71	84	119	98	89	165	126
1936	94	165	143	97	118	109	75	147	113
1937	90	191	127	105	146	122	87	140	122
1938	67	165	80	88	76	75	63	98	101
1939	70	131	98	86	73	72	58	103	109
1940	78	145	102	97	91	84	64	126	121
1941	107	184	93	108	99	95	68	162	145
1942	149	272	158	124	123	116	84	206	199
1943									
March	161	154	208	175	146	139	103	212	302
April	162	154	240	205	155	139	106	213	291
May	162	362	274	257	160	140	106	214	253
June	161	548	270	253	164	141	102	215	308
July	158	567	240	305	167	143	100	206	315
August	160	369	228	315	168	144	102	236	308
September	163	358	193	264	168	148	108	240	311
October	164	402	184	224	165	153	115	243	264
November	156	428	191	202	162	156	121	243	254
December	160	408	194	215	171	163	127	244	208
1944									
January	163	399	203	231	174	166	131	245	231
February	161	241	200	241	174	166	133	244	204
March	161	211	197	251	176	166	134	244	191

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Fish scrap, wet acidulated, 6% ammonia, 3% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.71	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943							
March	1.75	1.42	6.30	5.77	3.34	4.86	6.53
April	1.75	1.42	6.29	5.77	3.34	4.86	6.53
May	1.75	1.42	6.29	5.77	3.34	4.86	6.53
June	1.75	1.42	6.30	5.77	3.34	4.86	6.53
July	1.75	1.42	6.30	5.77	3.34	4.86	6.71
August	1.75	1.42	6.30	5.77	3.34	4.86	6.71
September	1.75	1.42	6.30	5.77	3.34	4.86	6.71
October	1.75	1.42	6.29	5.77	3.34	4.86	6.71
November	1.75	1.42	6.29	5.77	3.34	4.86	6.71
December	1.75	1.42	7.39	5.77	3.34	4.86	6.71
1944							
January	1.75	1.42	7.40	5.77	3.34	4.86	6.71
February	1.75	1.42	7.40	5.77	3.34	4.86	6.71
March	1.75	1.42	7.61	5.77	3.34	4.86	6.71
Index Numbers (1910-14 = 100)							
1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	136	129	139
1927	112	79	145	166	143	128	162
1928	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	112	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	121
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
1943							
March	65	50	180	163	110	144	186
April	65	50	180	163	110	144	186
May	65	50	180	163	110	144	186
June	65	50	180	163	110	144	186
July	65	50	180	162	110	144	191
August	65	50	180	163	110	144	191
September	65	50	180	163	110	144	191
October	65	50	180	163	110	144	191
November	65	50	180	163	110	144	191
December	65	50	211	163	110	144	191
1944							
January	65	50	211	165	110	144	191
February	65	50	211	163	110	144	191
March	65	50	217	163	110	144	191

Wholesale Prices of Phosphates and Potash**

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23.32	....	.474
1924	.502	2.31	6.60	.582	.860	23.72	....	.472
1925	.600	2.44	6.16	.584	.860	23.72	....	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537	.524
1927	.535	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	25.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.607
1940	.516	1.90	5.50	.517	.730	....	.573	....
1941	.547	1.94	5.64	.522	.779	25.55	.570	....
1942	.600	2.13	6.29	.522	.809	25.74	.205	....
1943								
March	.608	2.00	5.90	.535	.817	26.00	.210	....
April	.640	2.00	5.90	.535	.817	26.00	.210	....
May	.640	2.00	5.90	.535	.817	26.00	.210	....
June	.640	2.00	5.90	.471	.701	22.88	.176	....
July	.640	2.00	5.90	.503	.797	26.00	.188	....
August	.640	2.00	5.90	.503	.797	26.00	.188	....
September	.640	2.00	5.90	.503	.797	26.00	.188	....
October	.640	2.00	5.90	.535	.797	26.00	.200	....
November	.640	2.00	5.90	.535	.797	26.00	.200	....
December	.640	2.00	6.10	.535	.797	26.00	.200	....
1944								
January	.640	2.00	6.10	.535	.797	26.00	.200	....
February	.640	2.00	6.10	.535	.797	26.00	.200	....
March	.640	2.00	6.10	.535	.797	26.00	.200	....

Index Numbers (1910-14 = 100)

1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	110	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
1940	96	53	113	72	77	....	87	....
1941	102	54	110	73	82	106	87	....
1942	112	59	129	73	85	106	84	....
1943								
March	113	55	121	75	86	108	85	....
April	119	55	121	75	86	108	85	....
May	119	55	121	75	86	108	85	....
June	119	55	121	66	74	95	80	....
July	119	55	121	70	84	108	82	....
August	119	55	121	70	84	108	82	....
September	119	55	121	70	84	108	82	....
October	119	55	121	75	84	108	83	....
November	119	55	121	75	84	108	83	....
December	119	55	125	75	84	108	83	....
1944								
January	119	55	125	75	84	108	83	....
February	119	55	125	75	84	108	83	....
March	119	55	125	75	84	108	83	....

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922.....	132	149	141	116	101	145	106	85
1923.....	142	152	147	114	107	144	103	79
1924.....	143	152	143	103	97	125	94	79
1925.....	156	157	151	112	100	131	109	80
1926.....	145	155	146	119	94	135	112	86
1927.....	139	153	139	116	89	150	100	94
1928.....	149	155	141	121	87	177	108	97
1929.....	146	153	139	114	79	146	114	97
1930.....	126	145	126	105	72	131	101	99
1931.....	87	124	107	83	62	83	90	99
1932.....	65	107	95	71	46	48	85	99
1933.....	70	109	96	70	45	71	81	95
1934.....	90	123	109	72	47	90	91	72
1935.....	108	125	117	70	45	97	92	63
1936.....	114	124	118	73	47	107	89	69
1937.....	121	130	126	81	50	129	95	75
1938.....	95	122	115	78	52	101	92	77
1939.....	93	121	112	79	51	119	89	77
1940.....	98	122	115	80	52	114	96	77
1941.....	122	130	127	86	56	130	102	77
1942.....	157	152	144	93	57	161	112	77
1943								
March.....	182	163	150	93	57	160	113	79
April.....	185	165	151	95	57	160	119	79
May.....	187	167	152	95	57	160	119	79
June.....	190	168	151	93	57	160	119	69
July.....	188	169	150	94	57	160	119	74
August....	193	169	150	94	57	160	119	74
September.	193	169	150	94	57	160	119	74
October...	192	170	150	95	57	160	119	78
November.	194	171	150	95	57	160	119	78
December..	196	173	150	96	57	171	119	78
1944								
January....	196	174	150	96	57	171	119	78
February..	195	175	151	96	57	171	119	78
March.....	196	176	151	97	57	173	119	78

* U. S. D. A. figures.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

**** The annual average of potash prices is higher than the weighted average of prices actually paid because since 1926 better than 90% of the potash used in agriculture has been contracted for during the discount period. From 1937 on, the maximum seasonal discount has been 12%.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

¶ An interesting summary of data obtained by the Ohio Agricultural Experiment Station in various fertilizer experiments is given by R. E. Yoder in Fertilizers in the Farm Production Program, issued as Agronomy Mimeograph No. 91, Ohio Agricultural Experiment Station. The data were presented at a conference on land conservation and reconstruction held at the Ohio State University in January 1944. Investigations on the influence of season on response of corn to hill fertilization indicate that, when the early season is dry, hill fertilization is likely to produce injury to stand and yield if the rate of application exceeds 150 lbs. per acre. When rainfall in the early season is high, hill fertilization is highly profitable. The conclusion is drawn that, for practical purposes, hill fertilization rate is limited to about 150 lbs. per acre because of the possible danger of injury during dry seasons. A limited amount of data indicates that when corn is drilled, about double the rate of fertilizer should be applied as compared to hill-dropped corn.

Experiments on different placements of fertilizer, both at planting time and plowed down prior to planting, show that the broadcasting of phosphate-potash fertilizer is an insufficient method of placement regardless of time and depth of placement. It would appear as if all of the phosphate and potash should be placed in bands either at planting time or on the bottom of the furrow. Placing the fertilizer on the bottom of the furrow or plowing under fertilizer should be considered a supplement to and not a substitution for fertilizer applied near the seed at planting time. Applying the fertilizer on the bottom of the furrow offers an excellent and safe way of increasing the rate of application of fertilizer, although in the particular experiments reported from Ohio there were not great increases in yields from the extra fertilizer application. Relatively greater increases were obtained in some experiments reported from Indiana. The work would indicate that some phosphate and potash should be applied near the seed at planting time so as to favor early growth of the crop.

Yields of corn obtained from various rates of sulphate of ammonia applications ranging from none to 1,200 lbs. per acre show that substantial increases in yield were obtained by applications up to 400 lbs., and some increases by applications up to 800 lbs. per acre. It is brought out that when extra nitrogen is used the land should be liberally supplied with phosphate and potash so as to have a balanced fertility.

Experiments on plowing under sweet clover with lime and superphosphate showed that this program will not maintain soil fertility, with corn yields dropping off markedly and potash starvation in evidence on all the plants on those plots where no potash was added.

Results of outlying experimental fields indicate that fertilizer at the rate of 150 lbs. per acre on corn and 300 lbs. per acre of wheat is highly profitable at all locations. Phosphate-potash was better than phosphate alone, and the use of manure along with fertilizer gave big increases in yields.

Data on soybean fertilization indicate the difficulties that are being experienced in connection with the fertilization of this crop. The Experiment Station recommends that other crops in the rotation with soybeans be fertilized more heavily and residual effects be depended on to take care of the soybean crop until more is learned concerning successful fertilization of soybeans. Data are given on the approximate removal of phosphoric acid and potash in the grain by average yields of soybeans, corn, oats, and wheat. Each bushel of soybeans removes about one pound each of phosphoric acid and potash; corn, one-third of a pound of phosphoric acid and one-quarter pound of potash per bushel; oats, just a trifle less in each case; and wheat, one-half pound of phosphoric acid and one-quarter pound of potash per bushel.

¶ The report for the 1942 fertilizer inspections in Indiana, published as Circular 288, Purdue University Agricultural Experiment Station, entitled "Inspection of Commercial Fertilizers," contains the usual excellent compilation of information on fertilizer usage in Indiana for the year. Effects of wartime conditions can be noted in numerous tables. The high demand for fertilizers induced by high agricultural income and high wartime production goals is reflected by far the largest total tonnage of fertilizer ever sold in the State, well over 400,000 tons. The restrictions in nitrogen supplies caused a marked reduction in tonnage of complete fertilizers and particularly in the very popular 2-12-6 analysis. There was an even greater increase in the use of phosphate-potash mixtures such as 0-12-12, 0-20-20, 0-14-14, and 0-14-7. The calculated total consumption of nitrogen in 1942 was 3,800 tons compared to 6,523 tons the preceding year, a direct reflection of the restricted nitrogen situation in 1942. Available phosphoric acid consumption increased from 44,246 tons to 59,191 tons with corresponding increases in other forms of phosphoric acid. Potash increased from 30,575 tons in 1941 to 44,536 tons in 1942. The customary data on individual inspections also are included.

"Commercial Fertilizer Sales as Reported to Date for the Quarter Ended December 31, 1943," Bu. of Chemistry, Dept. of Agr., Sacramento, Calif., No. FM-75, Feb. 14, 1944.

"Analytical Tolerances for Commercial Fertilizers," Bu. of Chemistry, Dept. of Agr., Sacramento, Calif., No. FM-76, Feb. 18, 1944.

"Analyses of Official Samples of Gypsum Drawn Between January 1 and February 26, 1944," Bu. of Chemistry, Dept. of Agr., Sacramento, Calif., No. FM-79, March 3, 1944.

"Approximate Tonnage of Plant Food Sold in California Annually from 1937 to 1943," Bu. of Chemistry, Dept. of Agr., Sacramento, Calif., No. FM-80, March 8, 1944.

"Plant Nutrient Survey of Sugar Beets for 1943," Div. of Plant Nutrition, Univ. of Calif., Berkeley, Calif., Albert Ulrich.

"Poultry Manure," Agr. Ext. Serv., Univ. of Hawaii, Hawaii, Agr. Ext. Cir. 162, Oct. 1943.

"Preliminary Report on the Sales of Fertilizers in Canada During the Year Ended June 30, 1943," Dept. of Trade & Commerce, Dominion Bu. of Statistics, Ottawa, Can.

"Spend Money for Fertilizer Rather Than for Soil Testing," Univ. of Ill., College of Agr., Urbana, Ill., H342 (1944), Lee A. Somers.

"Restrictions and Suggestions for Wartime Fertilizer Practices," Dept. of Agron., Univ. of Ill., Urbana, Ill., AG1197, Feb. 1944, A. L. Lang.

"Report of Analysis of Commercial Fertilizers," La. Dept. of Agr. & Immigration, Baton Rouge, La., 1942-1943.

"Commercial Feeds, Fertilizers, and Agricultural Liming Materials," Univ. of Md., College Park, Md., No. 187, Aug. 1943.

"Maryland Fertilizer Facts for 1943," Inspection & Regulatory Serv., Univ. of Md., College Park, Md., March 10, 1944.

"Fertilizer Analyses and Registrations," Div. of Feed & Fert. Control, St. Paul, Minn., Feb. 1944, H. A. Halvorson.

"Fertilizer Recommendations for Spring and Summer Crops, 1944," Univ. of Missouri, Columbia, Mo., E. Cir. 504, Jan. 1944, A. W. Klemme and O. T. Coleman.

"Fertilizer for Fish Ponds," U.S.D.A. Lincoln, Nebraska, Sept. 1943.

"Fertilizer Recommendations for 1944 Preliminary," Agron. Dept., Univ. of New Hampshire, Durham, N. H., Sept. 10, 1943.

"Survey of Sales of Agricultural Liming, 1943," Agr. Exp. Sta., New Brunswick, N. J., Feb. 21, 1944.

"Survey of Sales of Fertilizers, 1943," Agr. Exp. Sta., New Brunswick, N. J., March 9, 1944.

"Fertilize Victory Wise in 1944," Cornell Univ., Ithaca, N. Y., Bul. 497, War Emergency Bul. 16, Rev. Jan. 1944, E. L. Worthen.

"Fertilizing Potatoes in 1944," Cornell Univ., Ithaca, N. Y., Bul. 551, War Emergency Bul 58, Rev. Jan. 1944, Ora Smith.

"Fertilizing Vegetables in 1944," Cornell Univ., Ithaca, N. Y., Bul. 557, War Emergency Bul 61, Rev. Jan. 1944, G. J. Raleigh and R. D. Sweet.

"Analyses of Commercial Fertilizers," N. C. Dept. of Agr., Raleigh, N. C.

"Fertilizing Vegetable Crops in Pennsylvania," Ext. Serv., Pa. State College, State College, Pa., April 1, 1943.

"Fertilizing Farm Crops in 1944," Pa. State College, State College, Pa., C. F. Noll and J. B. R. Dickey.

"Fertilizers for Garden Vegetables," Agr. Ext. Ser., Univ. of Tenn., Nashville, Tenn., Leaflet No. 66, Feb. 1944, W. C. Pelton.

"Report of Inspection Work Commercial Fertilizers and Limes," Dept. of Agr., Charleston, W. Va., Bul.(n.s.)36, July 31, 1943.

"Tobacco Fertilizer Experiments in Vernon County," Agr. Exp. Sta., Univ. of Wis., Madison, Wis., Research Bul. 148, Nov. 1943, James Johnson and W. B. Ogden.

Crops

¶ The Victory garden campaign has brought forth publications which are not only timely but have a permanent value in any grower's library. One of these publications is "Growing Vegetables in Town and City" by Victor R. Boswell and Robert E. Webster, U. S. Department of Agriculture Miscellaneous Publication 538. This large size, 40-page publication contains a wealth of practical information on growing vegetables in small gardens. Selection of the area, care of tools (a subject usually overlooked in such publications), preparation of the soil, the use of lime, manure, and fertilizer, selecting crops, planting seed, and culture during the season are covered, in general, for all crops. The latter part of the publication is devoted to specific information on 50 different garden crops. Excellent illustrations show how to turn under organic matter, apply fertilizer, plant seed, and transplant, while a suggested lay-out for a garden and hints on what to do are also given.

"Onion Production in California," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Cir. 357, Sept. 1943, Glen N. Davis.

"Establishing the Young Orchard," Ont. Dept. of Agr., Statistics and Publ. Branch, Toronto, Ont., Bul. 433, March 1943, W. H. Upshall.

"Grape Growing in Colorado," Agr. Exp. Sta., Colo. State College, Fort Collins, Colo., Bul. 484, Feb. 1944, George Beach and L. R. Bryant.

"Citrus Propagation," Agr. Ext. Serv., Gainesville, Fla., Bul. 96 (Rev. Oct. 1943), May 1938, A. F. Camp.

"Producing Quantity and Quality Flue-Cured Tobacco in Florida," Agr. Ext. Serv., Gainesville, Fla., Cir. 73, Dec. 1943, J. Lee Smith.

"Producing Peanuts in Florida," Agr. Ext. Serv., Gainesville, Fla., Cir. 75, Jan. 1944, J. Lee Smith.

"Growing Corn in Florida Under War-Time Conditions," Agr. Ext. Serv., Gainesville, Fla., Cir. 76, Feb. 1944, J. Lee Smith.

"Systematic Single Cross Yield Trials," Dept. of Agron., Agr. Ext. Serv., Univ. of Ill., Urbana, Ill., AG-1124, March 1943, C. M. Woodworth and Oren Bolin.

"1942 Experimental Hybrid Corn Trials in Illinois," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG-1128, March 1943.

"Prairie—A New Variety of Soft Red Winter Wheat for Illinois," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG-1155, June 1, 1943, O. T. Bonnett.

"Viking Soybeans," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG-1163, July 1943, C. M. Woodworth.

"Choosing Corn Hybrids for Indiana," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Bul. 492, Oct. 1943, S. R. Miles.

"Helps for the Home Garden," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., E. Bul. 238 (3rd Rev.), Jan. 1944, W. B. Ward.

"Alfalfa-Bromegrass Makes Good Pasture," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Cir. 290, Jan. 1944, J. H. Hilton, J. W. Wilbur, and G. O. Mott.

"Barley Production in Kansas," Agr. Exp. Sta., Kansas State Col., Manhattan, Kan., Bul. 318, Oct. 1943, A. F. Swanson and H. H. Laude.

"A Preliminary Report of Certain Variety, Fertilizer, and other Tests Conducted by the Crops and Soils Department of the Louisiana Experiment Station—1943," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., W. G. Taggart.

"Maine Garden Guide," Agr. Ext. Serv., Univ. of Me., Orono, Me., Cir. 190, Feb. 1944.

"Propagation of the High-Bush Blueberry by Softwood Cuttings," Agr. Exp. Sta., Mass. State Col., Amherst, Mass., Bul. 410, Nov. 1943, W. L. Doran and J. S. Bailey.

"Growing Red Raspberries for Market," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Bul. 199, (Rev.) June 1943, W. G. Brierley and J. D. Winter.

"Well-Managed Pastures," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Bul. 241, Jan.

1944, Ralph F. Crim and Paul M. Burson.

"Cotton Varieties in the Hill Section of Mississippi," Agr. Exp. Sta., Miss. State Col., State Col., Miss., Bul. 396, Jan. 1944, J. Fred O'Kelly.

"Cotton Variety Tests in the Yazoo-Mississippi Delta," Agr. Exp. Sta., Miss. State Col., State College, Miss., Bul. 398, Feb. 1944, J. Winston Neely and Sidney G. Brain.

"Improve Permanent Pastures with Lespedeza, Phosphate, Lime, and Supplementary Grazing," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 285, Feb. 1944, E. Marion Brown.

"Sweetclover in Nebraska," Agr. Exp. Sta., Univ. of Neb., Lincoln, Neb., Bul. 352, Dec. 1943, S. Garver, J. M. Slatensek, and T. A. Kiesselbach.

"Plowshares and Swords," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., 64th A. R., 1943.

"How to Recognize Some Common Alfalfa Troubles," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 616, June 1943, W. E. Colwell.

"Small Fruits for Home Use," N. C. State Col. of A. & E., Univ. of N. C., Raleigh, N. C., War Series Bul. 30, Jan. 1944.

"Official Variety Tests in North Carolina Corn Hybrids," Agr. Exp. Sta., N. C. State Col. of A. & E., Raleigh, N. C., Agron. Inf. Cir. 134, Jan. 1944, R. P. Moore and L. S. Bennett.

"Ohio Forest Plantings," Agr. Exp. Sta., Univ. of Ohio, Wooster, Ohio, Bul. 647, Jan. 1944, Robert R. Paton, Edmund Secrest, and Harold A. Ezri.

"Grow Small Fruits for Home Use," Ext. Serv., Pa. State College, State College, Pa., March 1, 1944, J. L. Mecartney.

"The Cotton Contest—1943, For Better Yield and Staple Value," Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 253, Jan. 1944.

"Garden for Victory," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Publ. 272, (Rep.), Feb. 1944.

"Available Publications of Vt. Agr. Ext. Serv. and Vt. Agr. Exp. Sta.," Agr. Ext. Serv., Univ. of Vt., Burlington, Vt., Brieflet 688, Dec. 1943.

"Neighborhood Leader's Digest," Ext. Serv., Va. A. & M. College, Blacksburg, Va., March 15, 1944.

"Winter Wheat for the 1944 Crop," Agr. Exp. Sta., State Col. of Wash., Pullman, Wash., Pop. Bul. 173, Sept. 1943, E. G. Schafer, O. A. Vogel, and S. P. Swenson.

"Fifty-third Annual Report," Agr. Exp. Sta., State Col. of Wash., Pullman, Wash., Bul. 435, Dec. 1943.

"Vicland Oats," Agr. Exp. Sta., Univ. of Wis., Madison, Wis., Bul. 462, Feb. 1944, H. L. Shands and B. D. Leith.

"The Midland and Fairpeake Strawberries," U.S.D.A., Washington, D. C., Cir. 694, Jan. 1944, George M. Darrow.

"Report of the Chief of the Office of Experiment Stations, Agricultural Research Administration, 1943," U.S.D.A., Washington, D. C., September 15, 1943.

Soils

¶ An excellent publication on orchards has been prepared by E. F. Palmer and J. R. Van Haarlem of the Vineland, Ontario, Horticultural Experiment Station, entitled "Orchard Soil Management," and issued as Bulletin 437 of the Ontario Department of Agriculture. After pointing out the fundamental importance of soil fertility in orchards, a brief description of soils is given. Several sections are devoted to the important subject of organic matter in the soil, including cover crops and their growth, and the use of manure and other organic supplements. The section on plant nutrients emphasizes that balance of nutrients is very important. The primary need for nitrogen in trees and fruit trees is discussed with the warning that this nitrogen must be properly balanced with phosphorus, potassium, lime and, at times, trace elements such as magnesium, boron, manganese, zinc, iron, and copper.

The soil requirements of the various fruit trees are mentioned and systems of handling orchard soil, especially from the viewpoint of clean cultivation and cover crops, are rather fully covered. The authors are very favorably inclined toward sod culture, but warn that this needs intelligent handling, not neglect. The value and importance of mulches for increasing availability of nutrients, conserving moisture, and improving the yield are brought out. The desirability of soil testing to determine fertilizer needs and deep placement of fertilizer are discussed, and the bulletin ends with a brief description of nitrogen, phosphorus, and potassium-deficiency symptoms on fruit trees.

The authors have supplemented their own wide experience and careful investigation with quotations from numerous other sources. The subject matter is well covered without going into great detail. The publication therefore

can well serve as a guide for orchardists in the management of their soils.

"Orchard Soil Management," Hort. Exp. Sta., Vineland Station, Ontario, Bul. 437, Jan. 1944, E. F. Palmer and J. R. Van Haarlem.

"Put Conservation Farming Behind War Food Production," Agr. Ext. Serv., Univ. of Florida, Gainesville, Fla., Ext. Cir. 74, Jan. 1944, K. S. McMullen.

"Soils of High-Rainfall Areas in the Hawaiian Islands," Hawaii Agr. Exp. Sta., T. Bul. No. 1, Sept. 1943, A. S. Ayres.

"Effect of Contour Farming on Soil and Surface Water Losses and on Plant Nutrient Losses from Tile Drains and from Erosion Type Lysimeters," Agron. Dept., Agr. Exp. Sta., Urbana, Ill., AG1158, June 1943, R. S. Stauffer, C. A. Van Doren.

"Effect of Crop Residues on Runoff and Erosion," Agron. Dept., Agr. Exp. Sta., Urbana, Ill., Ext. AG-1159, June 1943, C. A. Van Doren, R. S. Stauffer.

"Better Crops by Erosion Control," Agr. Ext. Serv., Rutgers Univ., N. J., Lindley G. Cook.

"The Influence of Cropping on the Nitrogen, Phosphorus, and Organic Matter of the Soil Under Irrigation Farming," Agr. Exp. Sta., Utah State Agr. College, Logan, Utah, Sta. Bul. 310, Sept. 1943, J. E. Greaves and C. T. Hirst.

"Water-Application Efficiencies in Irrigation," Agr. Exp. Sta., Agr. College, Logan, Utah, Bul. 311, March 1944, Orson W. Israelsen, Wayne D. Criddle, Dean K. Fuhriman, and Vaughn E. Hansen.

"Practical Irrigation," U.S.D.A., Washington, D. C., FB1922, Jan. 1944, M. R. Lewis.

"Sagebrush Burning—Good and Bad," U.S. D.A., Washington, D. C., Farmers Bul. 1948, Jan. 1944, Joseph F. Pechanec and George Stewart.

"Protect Terrace Outlets with Grass for Food Production," U.S.D.A., Washington, D. C., AWI-79, November 1943.

Economics

¶ A survey of practices by the lima bean growers in Delaware conducted by the Delaware Agricultural Extension Service furnishes information of use and value to the growers of this crop. This survey is reported by E. P. Brasher in Delaware Mimeo. Circular 31 entitled "Lima Bean Cost and Management Study." Twenty-six growers in the State in 1943 furnished the data for this survey. The unfavorable season for this crop is reflected in the fact that the records show only three grew the crop at a profit. Yields were the lowest on record, varying from 276 to 1,279 lbs. per acre, with an average of 642 lbs. Those who harvested their beans when they graded more than 88 per cent green beans, usually realized a greater income from the crop. Investment in manure, fertilizer, and other improved cultural practices usually resulted in increased yields and income per acre. Placing the fertilizer in bands, practiced by 10 of the cooperators, resulted in an average yield of 721 lbs. per acre, while 16 operators who broadcast their fertilizer had a yield of only 593 lbs. Most of the cooperators used manure with the resulting benefit in yield. The 21 cooperators who used manure had an average yield of 670 lbs., while the 5 who did not use manure had a yield of 522 lbs. The most popular fertilizer analysis was 4-8-12, with the rate of application usually around 500 lbs. per acre. Over half of the cooperators used lime of some form.

While these results for only one year are not very encouraging, they do show that improved practices are likely to be worth while even in unfavorable years.

¶ A good way to obtain information on how to improve the farm business is to study the results obtained by various farmers, so as to see which systems are likely to produce greater profits. This has been done by K. T. Wright of the Michigan Agricultural Experiment Station, who reported his results in Special Bulletin 324 of the Station, entitled "Dollars and Sense in Farming." A survey in lower central Michigan was conducted during the period 1933 to 1938. This section of the State is devoted largely to dairying and general farming. The kind of soil on the farm had a big influence on the return from farming operations, the labor income of farms on the best soil being nearly double that on the farms located on third-class soil. The larger farms, those over 200 acres, had a larger labor income than the smaller farms, but regardless of size, the more intensively farmed enterprises had a greater income than those less intensively operated. Growing cash crops increased

labor income while the farms which tended to have higher acreages in hay and pasture had a lower income. Those farms which grew more legumes had a higher income and, as was to be expected, the farms which had high yields per acre had higher income. Livestock provided a large part of the income, and those farms which had more livestock, therefore, had a larger income.

Labor efficiency was very important in determining income from the farm, the efficiency being more important on large farms than on smaller farms. A high machinery investment was profitable provided the size of the farm was such as to permit full utilization of the machinery. Good buildings when properly utilized improved farm income, although in and of themselves, they were of no particular value. Expenditures for fertilizer, good seed, and proper feed were usually very profitable. Owners usually had a higher labor income than renters. In a period of falling prices, such as occurred during the depression, the farms in all cases were not profitable and here the larger farms suffered the greatest losses, although the more efficiently operated had smaller losses than the less efficiently operated. The findings of this Bulletin are very significant, not only to Michigan farmers, but to those in other sections of the country in determining types of enterprises and management systems to be followed.

"Planning for Delaware Agriculture," Agr. Ext. Serv., Univ. of Delaware, Newark, Dela., Mimeo. Cir. 30, Jan. 1944.

"Lima Bean Cost and Management Study, Delaware—1943," Agr. Ext. Serv., Univ. of Dela., Newark, Dela., Mimeo. Cir. 31, Feb. 1944, E. P. Brasher.

"Estimated 1943 Production of 12 Crops Hawaii, Maui, and Oahu," Agr. Ext. Serv., Univ. of Hawaii, A. E. Cir. 167, March 1, 1944.

"Profitable Farm Organization in Northwestern Indiana," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Bul. 491, Feb. 1944, Lynn Robertson.

"The Outlook for Indiana Agriculture 1944," Dept. of Agr. Ext., Purdue Univ., Lafayette, Ind., E. Bul. 302, Dec. 1943.

The Potash Problem in Illinois

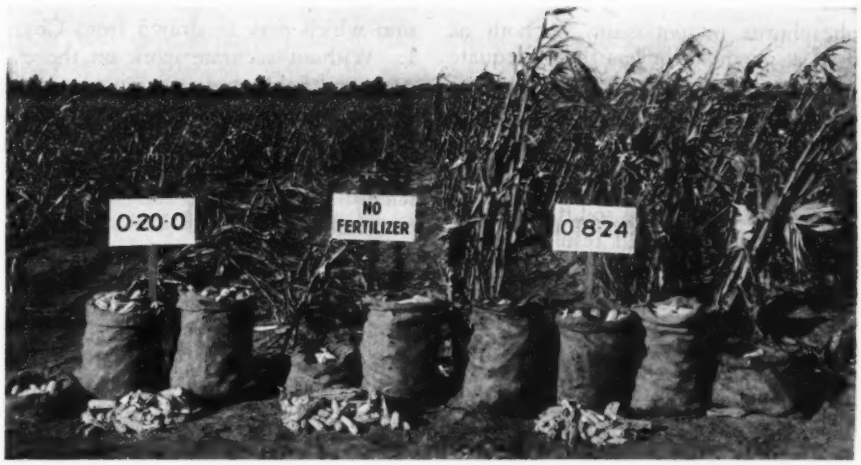
(*From page* 16)

order of this value is also the order of the total profit per acre from fertilizer use. The complete treatment gives the most profit ($26.88) but requires the highest initial investment ($14.22). On the other hand, where only one-half the full requirements for both phosphorus and potassium are added, the gross value of the increases ($27.40) is next in order of profit, although the initial investment per acre is only one-half as much ($7.11).

Using the full requirement for either phosphorus alone or potassium alone gives lower returns. As is well known, where two deficient nutrients are added there is a bonus for their use together. This bonus is readily calculated with the new method of soil test interpretation presented in this paper.

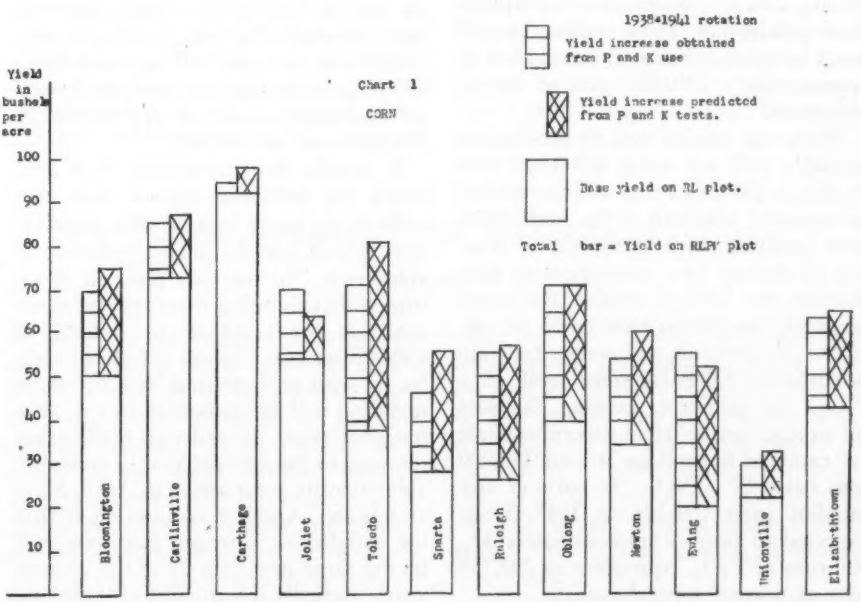
Now, how accurately can test predictions be calculated? Could we, by testing a soil in 1935, have predicted what the increases would be for phosphorus or potassium or for both used together for the rotation of 1938 to 1941? The proof of the pudding lies in the eating.

Chart 1 shows just such a prediction for some of the experiment fields. The tests of soil samples taken in 1935 were used as a basis for calculating what the combined increase for both phosphorus and potassium use should be, during the 1938-1941 rotation. The lower part of the bar shows the yield on the RL plot where residues, legumes, and limestone had been used. The left-hand side of the upper bar shows the increase in yield actually obtained, while the right-hand side shows the yield as calculated from the soil tests made on 1935 samples and the yield obtained on the RL plots.



A demonstration in southern Illinois, showing the need for potash fertilizers. The phosphate plot (0-20-0) yielded 33 bushels per acre; the no-fertilizer plot 22 bushels, and the phosphate and potash plot (0-8-24) yielded 55 bushels. The fertilizer was applied at the rate of 125 pounds per acre.

The agreement between the increase obtained for phosphorus and potassium use and the increase as calculated from the soil test data are certainly sufficiently good to warrant recommending this method as a practical method of soil nutrient diagnosis. For both phosphorus and potassium, it tells how deficient the soil is or the percentage deficiency; it gives the approximate fertilizer requirement; it calculates the approximate increases in yields which will be obtained in cases where past yield records are available or can be estimated; and it permits an economic interpretation of the relative use of



phosphorus or potassium or both as used at adequate or less than adequate rates.

This means that we are in reality making a synthetic experiment field especially for each farmer. The results from this synthetic field apply more closely to each farmer's soil than do any actual experiment field results because they are for a soil testing exactly the same as the farm soil tests. The accuracy of this so-called synthetic field data is only limited by the accuracy of the experiment field data themselves and the chemical test values. That they both are highly accurate is one conclusion which may be drawn from Chart 1. Without accurate work on the experiment fields and accurate work in the laboratory, such a correlation as shown on Chart 1 would have been impossible. It demonstrates the value of scientific research in the solution of practical problems.

In conclusion, we can say that farmers who are doing a good job of farming as far as rotations and other factors in soil management are concerned can find in the soil tests a ready solution to their phosphorus and potash problems.

Record Supplies of Fertilizer Materials Indicated for 1944-45

(*From page* 18)

mately 175,000 tons of this new production will be in the form of triple superphosphate. In addition, projects have been approved for the expansion of sulphuric acid facilities by acidulators having excess capacity for superphosphate production. These projects should result in increased annual production of approximately 200,000 tons of superphosphate.

While the annual rate of production probably will not reach 8,000,000 tons by July 1, 1944, that rate will be reached or exceeded when all of the authorized new facilities reach production. Taking all factors into consideration, production in 1944-45 under the most favorable conditions that could be obtained in wartime will amount to approximately 8,000,000 tons, basis 18% P_2O_5. In addition, existing facilities for production of triple superphosphate are expected to produce at least 350,000 tons basis 45% P_2O_5. Imports of ammophos from Canada in 1944-45 are expected to provide approximately 37,000 tons of P_2O_5, equivalent to 205,555 tons of normal superphosphate.

Nitrogen

The outlook today indicates that nitrogen supplies for agriculture in 1944-45 will be approximately six per cent larger than in 1943-44. Although allocations for the current fertilizer year have not been completed beyond April, it is estimated that the total will approach 675,000 tons of nitrogen, as compared with an estimated supply of approximately 716,000 tons in 1944-45.

It should be emphasized that estimates for both the current year and 1944-45 are based upon certain assumptions which may be subject to considerable error. In the first place, it is assumed that shipping space will be made available for bringing in a total of 650,000 tons of Chilean nitrate of soda by the end of June and that the same quantity will be imported in the next fertilizer year. In order to realize that tonnage in the current year, a considerable quantity must arrive in April, May, and June. Another assumption is that the supplies of nitrogen solutions will be the same next year as in the current year. Actually the amount of these ma-

terials will depend largely upon the ability of the fertilizer industry to utilize it. Larger quantities could have been delivered this season if fertilizer manufacturers could have utilized them. The estimates for ammonium phosphate are rather tentative and subject to change from time to time, largely because of shipping difficulties at the Canadian plants. A further assumption affecting several nitrogen materials is that the military rate of consumption in 1944-45 will continue at the rate estimated by military authorities for June 1944. These authorities will not estimate their requirements beyond June.

Based on such assumptions, supplies of ammonium sulphate, nitrogen solutions, Uramon, synthetic nitrate of soda, Chilean nitrate of soda, and Cyanamid are expected to remain at practically the same level as in the current season. Cal-Nitro will probably be increased by approximately 1,000 tons of nitrogen and the supply of by-product nitrate of soda is expected to reach approximately 6,700 tons of N in 1944-45. The outlook is for considerably more ammonium phosphate provided the shipping difficulties can be overcome. The tentative estimate is that the supply of 11-48 ammophos will reach 4,290 tons of nitrogen in 1944-45 as compared with 1,925 tons in the current year, with 16-20 increasing from 10,245 tons of nitrogen to approximately 14,750 tons. In organic nitrogen a 50 per cent increase is expected over the 20,000 tons of N estimated for 1943-44. The larger part of the total increase in nitrogen supply is expected in the form of ammonium nitrate, with an increase from 91,000 tons of N to approximately 144,000 tons.

In summarizing it may be said that according to present indications domestic agriculture (including Hawaii and Puerto Rico) will have available for 1944-45 approximately the following: 700,000 tons of K_2O from primary potash salts; 1,538,000 tons of P_2O_5 from superphosphate, triple-superphosphate, and ammonium phosphate; and 716,000 tons of nitrogen. As compared with 1943-44, these quantities represent an increase of approximately 16 per cent in K_2O, 17 per cent in P_2O_5, and 6 per cent in nitrogen. For the three combined, the anticipated supplies for 1944-45 are equivalent to approximately 2,955,000 tons as compared to approximately 2,597,000 tons in 1943-44, an increase of approximately 13 per cent. It should be emphasized that the above estimates do not assume any plant expansions beyond those already approved. Furthermore, it is assumed that no potash exports will be required by the United Kingdom and that total exports of this material to other countries will be no greater than the quantities already approved.

A New Approach to Extension Work

(*From page* 24)

workers are now strong voices armed with scientific facts entering vitally into the way of life and the standard of living of all the people of their respective counties. In conjunction with these are the state extension workers and the cooperating personnels. Together they make an alert and powerful team working in unison on a big job for and with a worthy people.

Results reveal that what we have done has been sound and effective. In Alabama, for example, cotton production has climbed from an average of 180 pounds per acre in pre-extension days to 283 in recent years, an increase of 57 per cent. This is remarkable in view of the fact that the pioneer county agents began work with a feeling that cotton production was doomed.

Through the spread of scientific in-

formation from our Experiment Station by the Extension Service to the farmers and their use of it, Alabama agriculture is being remade and improved in every way. If this had not been done in every state, our country would not now be in a position to fight a world war in the remarkably successful way to date, and with the genuine hope of victory, perhaps in Europe in 1944.

Without the improvements, already made in farming, our food production would not be adequate for ourselves. Instead of a shortage we are now supplying ourselves and contributing large quantities to our friends and cofighters abroad. This change was not accidental. It is a result of intelligent work well done.

Unawarely, perhaps, but fortunately, American farmers have been leaders in preparing for war—the front-line people in preparedness by their acceptance and use of the continuous flow of scientific information. This has enabled fewer people on farms to feed and clothe more—to make our great country sounder at the taproot, which is agriculture.

An example of this is the fact that grain feed now required to supply our total needs of meat, milk, wool, and eggs is about half what it was before extension work began, preceded by research work. This fact is especially significant at present when our livestock and poultry industry is limited by grain feeds available; and these products are major factors in the battlelines of the world. There would be no adequate livestock industry in this country if research had not learned how to control hog cholera, Texas fever in cattle, Bang's disease, bovine tuberculosis, anthrax, blackleg, other diseases, and both internal and external parasites.

All across the board farm production has improved and increased in response to needs. In 1942 our food production hit an all-time high, to be exceeded in 1943 even with unfavorable weather in many states. The 1942 food production score was 42 per cent above the war-year of 1918. Yet our farm population in 1942 was only 21 per cent of the total against 30.5 per cent in 1918. From 1890 to 1910, before extension work was organized, the increase in food production per farm was equal to only 0.7 person; from 1920 to 1940 the increase was 5.1 persons. This is one reason why the American people now eat more and better food than at any time in the past, except for a few deficiencies due to war. In 1942, eight per cent more than during any previous year was eaten by the average civilian.

This farm progress has been focused upon the farm home, for which and around which every sound rural program must function. Unless family life is improved and the farm home is a success, extension work is for naught. Our work must reflect in the food they eat, the clothes they wear, the buildings in which they live, the ideals they acquire, the deeds they do. These achievements have been in production and are remarkable, but they are by no means all that we now hope to and must accomplish. An honest confession is that most of the job is yet to be done.

What Is Farming?

In its essence farming is land use. As land use improves, farming improves. A farmer succeeds in production in proportion to his efficiency in the use of land, which includes practical conservation. If land is not properly conserved by a farmer, he is not using it wisely and is, therefore, on the way to grief, if not already there. Efficient use of land requires efficient use of labor, equipment, capital, and livestock. Efficient use is another way of saying intelligent work, of which much more is in order.

In traveling recently over Alabama I have observed much idle land. Along with it I have observed winter idle-

Shocks of oats on the experimental farm at the Alabama Experiment Station, Auburn.

ness of labor, of livestock, of equipment, and of money invested in the land, the improvements, machinery, and other things. It is like unto an idle manufacturing plant—men, machines, and building not working, not producing, deteriorating.

Best procedure in production is efficient work all the year by all the people, all the land, and all the equipment, because work creates wealth. When land is growing legumes or small grain during winter, for example, it is working. If nothing is growing on it, idleness prevails and losses occur. Livestock that are gathering their feed by grazing are doing work that otherwise man would be required to do. Implements standing idle either in a shed or in the open are not producing.

The above is introductory to our production program now being launched in conjunction with an improved educational service on our part in the field of marketing farm products. For many years we have observed increases in the cost of distribution of farm products in relation to the cost of production—a change in the wrong direction. If we divide all of the cost of consumer goods into production and distribution, we find that distribution has grown bigger and bigger in relation to production. This means increased cost to consumers with no corresponding returns to producers. Both producer and consumer are penalized.

This handicaps farmers in two ways. First, it brings severe criticism by consumers who are not informed as to the actual facts. They attribute their higher prices to farmers. Second, it restricts the consumption of farm products; and it also increases prices which farmers must pay when they buy.

These developments have created a need for intelligent information on marketing and distribution, similar to our information on production. Unless the Extension Service meets the marketing challenge, the time will come when another agency will be created to meet it. I am certain that this would be a mistake.

Our combination service of production and marketing must be based upon the land itself, as is true of all agriculture. It becomes obvious, therefore, that the production program for any farm, or any soil division of the State, should give first consideration to the production qualities of the soil itself.

Dean M. J. Funchess and his associates in agricultural research recognized this when they established experiment stations on major soil divisions of Alabama. These stations have accumulated and promulgated much information for better production of crops and livestock on these different soils, or areas.

It now becomes our duty to adjust our extension program by areas, in cooperation with farmers themselves, for the best possible use of information already available and for other information as it becomes available. Such procedure makes an inseparable link of research and extension, which are one in service to the people of the State, especially the farm people.

The newness of this program is more a departure and expansion, an enlargement, an unfolding. At the outset extension work dealt with little jobs and individuals. Now it must deal with the entire farm operation from the beginning of production to the consumer of the product and with the total rural economy. It approaches the farm and the family as a unit, then the neighborhood, the community, the county, the State. Individual action must result in collective action by all who are concerned.

We realize that every community problem is a national problem and that there is no national problem the essence of which isn't found in every community. We realize also that farming is not a one-cylinder job but an eight- or twelve-cylinder job. Since we are concerned with the total welfare of farm people, our extension program in Alabama is being streamlined and unfolded accordingly.

Our Greatest National Asset

(*From page* 26)

tional source of wealth. Millions of acres have been scientifically protected and are now producing an average of 20 per cent more than they did before.

But I am told that about 90 per cent of the conservation job lies ahead.

Just what is there to be done? How many men and how many years will it take to do it? What will it cost? Fortunately these questions have been anticipated and studied by the Soil Conservation Service. A nation-wide survey has already been completed showing how much land needs treatment and where.

Here is some of the work that should be done. We need to build six million miles of terraces across sloping land on 95 million acres, to control water and protect the soil.

We need to drain about 30 million acres of some of our richest land, which is too wet for full production.

We need to build thousands of stock ponds for better livestock production, particularly in the West.

We need to improve our farm irrigation and water use on 12 million acres in our drier regions.

We need to plant soil-building and erosion-resistant crops on thousands of mutilated fields.

There is other soil conservation work to be done by the farmers themselves and their neighbors. For example, 120 million acres of our farm land needs to be plowed on the contour. There is a need for stripcropping on 90 million acres and for improvements of about 110 million acres of pasture. There are 40 million acres of unfavorable land now in cultivation that should be planted to grass, legumes, and trees as quickly as possible.

Fortunately farmers have become so conscious in recent years of the importance of soil conservation to their prosperity and security that they have already developed much of the machinery necessary to carry out this work. Seven years ago farmers organized their first soil conservation district. This enabled the farmers in that district to work together in a com-

mon effort to safeguard the land in that district. It worked so well that today there are nearly 1,000 of these soil conservation districts. These include about 2½ million farms and ranches that cover more than 500 million acres. In other words, the people themselves on the land are already actively on the job, so that what I have suggested is no new scheme.

With victory in war, we can look forward to an era of peace. We can, if we will, look forward as confidently to ultimate success in our efforts to prevent the loss of our natural resources. What will that success bring?

Effective Conservation

Let us use our great Mississippi Valley as an example of what we might expect in our other great watersheds on both coasts. I believe it is not too much to visualize a system of effective control over our soil and water resources.

This would include using the rainfall on the plains and hillsides where it falls, instead of letting it run off in waste.

It would include the many additional soil conservation districts that will then be joined in this common effort.

It would include an automatic form of natural crop insurance against drought; water stored in the soil during wet seasons would be available for crops in dry seasons.

It would include large dams on the rivers and thousands of small dams on tributary streams and in pastures and fields, to give us flood control.

It would include electric power generated at the dams and flowing out over the productive countryside to the millions of farm homes that need it.

It would include protecting these dams against destructive silt, to insure our hydroelectric power—increasingly important in the years ahead as we view our diminishing supplies of coal and oil reserves.

It would also include a decentralized industrial development so that the raw materials would be close to the heart of the business community.

It would include a suitable network of highways and railroads and airlines as a natural part in this development.

It would include millions of farm homes made more secure against the future.

It would mean our ability to survive, for regardless of what we do, what plans we make, or what genius we may possess, our nation must perish unless we take care of the soil.

The soil of our country is our heritage. If wisely used its value, its strength, and its productivity are ageless. In peace or in war no nation can afford to waste its substance. The children of the future have a stake in this—our greatest source of national security.

Borax Sprayed on Beets Controls Black Spot

(*From page* 21)

eased plants to 6 per cent or less. The single treatment on August 7 had no measurable effect. Unfortunately a single treatment on July 8 was not made. It is evident, however, the early treatment was the more effective one of the two. In field 2 where the percentage of diseased plants was much lower in the untreated plots the single spray of 20 lbs. per acre on July 8 was highly effective, reducing severely affected plants to less than 0.4 per cent.

It is not possible to determine from these experiments whether a mid-season spray could be used to replace entirely soil treatments before sowing. They do demonstrate, however, that a heavy spring application is not a guar-

antee against severe losses from black spot. They also show that a supplementary mid-season spray, applied at the proper time, did reduce black spot to a negligible figure. With a crop like canning beets, where the presence of a relatively small amount of black spot may result in rejection of the entire crop, it is the more important to have a control measure which can be relied upon to bring the product through in good condition for processing. It is hoped that further study of this method can be carried out next season.

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The Importance of Potash in Maintaining Food Production in North Carolina

(*From page 7*)

of locations reported does not give complete assurance that the data are fully representative of the areas.

The demand for soybeans for oil in the war program has recently focused attention on the fertilizer requirements of this crop. Seed yields in eastern North Carolina have been too low for sustained profitable production. Field surveys have revealed a very widespread occurrence of potash deficiency symptoms on this crop. Reliable potash response data on soybeans in this State are rather meager. Three experiments were conducted during the 1943 season, two on Portsmouth sandy loam and one on Dunbar sandy loam. Yield responses of 3.9, 7.1, and 8.2 bushels respectively were obtained from applications of 36 pounds of K_2O. Calculated to yield responses per ton of K_2O these amounted to 117, 394, and 455 bushels

Response of cotton to additional potash, Rocky Mount, N. C. Left, 24 lbs. K_2O per acre; right, 48 lbs. K_2O.

respectively. Observations to date indicate that potash is one of the greatest, if not the greatest, limiting factor in soybean production in eastern North Carolina.

The entire staff of soil fertility workers in the Department collaborated in summarizing the data on which this article is based. Special credit is due W. H. Rankin, W. W. Woodhouse, W. L. Nelson, and W. E. Colwell.

Bottlenecking

(*From page* 5)

wouldn't say that advice and those scientific hints have been any bottleneck worth mentioning.

NOW take the case of a gent I know pretty well, who has ignored the free tips on how to make his cornstalks and marsh hay palatable and nutritious with certain added supplements high in protein, minerals, and vitamins.

For years he has practiced malnutrition on his stock and thrived on it, he says. But along came the recent bottleneck in protein that everybody was squawking about. His feed dealer refused to sell him some oil meal and tankage, although I don't know yet how he ever came to inquire for it. Well, this chap suddenly got religion and tore around raving that America had gone Sovietish, that we were being regimented, stinted, and deprived terribly. He kicked up a fuss at town meeting and abused the AAA committeemen, talked about monopolies by the big millers, and wrote Marvin Jones about it.

The main thing that ailed him was that when something he never used before got scarce and they couldn't sell him any right off, he decided he wanted that more than anything in the universe. If we could fix it somehow so that protein would continue on the tight list for a few seasons, I am sure we would overcome a heap of resistance to using more efficient livestock feeding methods. Why, even the lean-landers would be trying to grow their share of protein and would find out how to use it best in winter rations. So I think a few bottlenecks properly adjusted once in awhile do more good than a surplus to dispose of at give-away prices.

The root of the trouble simply is that this country has always lived so high and had so much of everything that we don't appreciate our natural resources and our everyday opportunities until some kindly old bottlenecker comes drooping along to give us the stop signal. And how we hate him for it, brothers! We cuss him for obstructing us in the name of common welfare, and the next breath finds us praising the freedom of choice and brotherly love of a democracy like ours. We are wearing many jewels of rank inconsistency, and maybe we pay a tax on them too.

OF course, the wickedest old bottleneck we have had to pester us for many moons has been in relation to prices and production. The law of supply and demand has been invoked too soon and too often, to the detriment of protective food production.

What I mean is this: Hitherto in normal times it has been impractical for the farmers to furnish the amount of nutrition actually required to continuously supply the balanced diets we need for a strong and vigorous population. When farmers went into it in a big way with vim and skill, the result was a burdensome market situation on the one hand and thousands of underfed youngsters on the other.

Finding that repeated booms in

milk, eggs, green vegetables, and sundry other things like fruits and fats, only left the producer prostrate and surrounded by his creditors, the game was altered by the referees in 1933 and agriculture imitated big business by curbing and trimming the output to meet the current demand at what was deemed fair prices.

The trouble was that it did not cure the hunger or enhance good will by consumers, who might go without fancy manufactured gadgets longer than they could be minus menus. And there were always plenty of farmers who merely shifted their efforts from one restricted product to another, or who grassed down their land and made livestock products instead of cash crops. It was such a blamed unnatural and provoking scheme that nobody ever wants to return to that method of evening things up.

Sensibly, we need a plan worked out to stimulate enough mass earning power by using advanced plans for continued production in cities when the war ends, so that farmers may find encouragement to maintain soil fertility and extend production of the most nutrition they can make per dollar of cost. It must not be just a flash period of employment, but a steady stream involving not only refilling depleted orders but inventing new things to stimulate trade. Do we see some signs of a stronger sense of reality and progress by large groups of manufacturers, now planning for full employment for the postwar era? Just to "dam-it-all-to-hell" about past errors will not bring us into the promised land, even with political platforms.

WE cannot look for miracles or an entirely upset economy. We cannot grow good pastures without preliminary treatment any more than we can hope to do the impossible in commerce. There will be some disappointments and some unbalanced diets left, as well as a few farm failures and foreclosures, no matter how eagerly we try to puzzle it out toward universal security.

I even go so far afield as to say that maybe we don't want to bust that bottleneck entirely open anyhow, because if everybody was assured of a lifetime of easy-street living I guess there would be no incentive left for inventions or soil improvement or better livestock. Sure, it isn't nice to feel driven to duty by fear of destitution, but there must be a sane middle-ground somewhere. If a democracy can't locate it, then we are sunk to the springs in a sea of despond, because no country ridden by despots can ever hope to.

FINALLY, I can't quit without reference to the splendid way our farmers have stepped into certain bottlenecks hereabouts and started things going again. The worst one was the labor supply, and probably the most widespread, at least in the northern states. Heralds shouted "Here comes the toughest thing yet," and the country cowered in fear of what might happen to their breadbaskets. So far it hasn't materialized in the shape it was predicted, and only because it was a local issue settled in a noble local way.

Toward the end of the coming summer we are promised another astounding bottleneck, which probably can't be solved so easily by local manpower as the labor dearth was. I refer to the oft-hinted breakdown of open country transportation facilities. The jalopies are on their last legs and the motors are wheezing. Will someone have to start breaking in oxen, owing to the lack of horseflesh, just when we learned to sing Mairzy Doates? Or will the armies assign fleets of brown transport trucks to tote the provisions?

And still I refuse to get panicky. I have so much faith in the eventual brittleness of bottlenecks and the strong arm of the home-folks to break 'em.

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Fertilize Potatoes for Quality and Profits (Pacific Coast)
Fertilizing Small Fruits (Pacific Coast)
Better Corn (Midwest) and (Northeast)
Fertilize Pastures for Better Livestock (Pacific Coast)
Of Course I'm Interested (Pastures, Canada)
Meet the Family (Canada)

Reprints

T-8 A Balanced Fertilizer for Bright Tobacco
N-9 Problems of Feeding Cigarleaf Tobacco
T-9 Fertilizing Potatoes in New England
MM-9 Fertilizing Tomatoes in Virginia
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
J-4-40 Potash Helps Cotton Resist Wilt, Rust, and Drought
S-5-40 What Is the Matter with Your Soil?
K-4-41 The Nutrition of Muck Crops
Z-9-41 Grassland Farming in New England
BB-11-41 Why Soybeans Should Be Fertilized
EE-11-41 Cane Fruit Responds to High Potash
HH-12-41 Some Newer Ideas on Orchard Fertility
B-1-42 Growing Ladino Clover in the Northeast
E-2-42 Fertilizing for More and Better Vegetables
F-2-42 Prune Trees Need Plenty of Potash
C-3-42 More Legumes for Ontario Mean More Cheese for Britain
H-3-42 Legumes Are Essential to Sound Agriculture
I-3-42 High-grade Fertilizers Are More Profitable
P-5-42 Purpose and Function of Soil Tests
Q-5-42 Potash Extends the Life of Clover Stands
S-6-42 A Comparison of Boron Deficiency Symptoms and Potash Leafhopper Injury on Alfalfa
T-6-42 The Fertilization of Pastures and Legumes
Y-8-42 The Southeast Can Grow Clover and Alfalfa
Z-8-42 The One-Mule Farmer Needs a New Machine
AA-10-42 Growing Legumes for Nitrogen
DD-10-42 Clover Pastures for the Coastal Plains
FF-11-42 Boron in Agriculture
GG-11-42 Some Experiences in Applying Fertilizer
HH-11-42 The Nutrition of the Corn Plant
II-12-42 Wartime Contribution of the American Potash Industry
JJ-12-42 The Place of Boron in Growing Truck
A-1-43 The Salt That Nearly Lost a War
B-1-43 Crotalaria—A Crop That Grows Like Weeds
C-1-43 Quality in Grasses for Pasture and Hay
D-1-43 For Hershey Orchards—Complete Fertilizer
E-1-43 Borax for Alfalfa in Tennessee
F-1-43 Boron Improves Canning Beets
H-2-43 Plant Food for Peach Profits
J-2-43 Maintaining Fertility When Growing Peanuts
K-2-43 Feeding Minerals By Way of the Soil
M-3-43 Lespedeza Is Not A Poor Land Crop
N-3-43 Boron and Potash for Alfalfa in the Northeast
O-3-43 Indirect Nitrogen Fertilization
P-3-43 Ohio Farmers Try Plow-Under Fertilizers
S-4-43 Plow-Sole Fertilizers Benefit Tomatoes
T-4-43 Fertilizing Tung Trees by Leaf Analysis
V-4-43 Permanent Pastures Need Help
W-4-43 The Soil Is the Basis of Farming Business
X-5-43 Malnutrition Symptoms & Plant Tissue Tests of Vegetable Crops
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
AA-5-43 Can Legumes Be Over-Emphasized?
BB-6-43 Sericea Is A Good Crop
CC-6-43 Putting Fertilizer Down Puts Crops Up
EE-8-43 Pastures—That Come to Stay
FF-8-43 Potash for Citrus Crops in California
HH-8-43 More Soybeans, Please!
JJ-10-43 Soil Management for Field Beans
KK-11-43 How Rotation Paid in North Carolina
LL-11-43 The Effect of Liming Materials Upon the Solubility of Potassium Compounds in the Soil
MM-11-43 Mississippi Farmers Improve Their Soil
NN-11-43 Maintaining Available Potassium in Soils
OO-11-43 Kudzu Conserves Southern Soils
PP-12-43 Commercial Fertilizers for Livestock Farms
QQ-12-43 Potash in War Production.
A-1-44 What's in That Fertilizer Bag?
B-1-44 Available Potash in the Surface Soils of Georgia
C-1-44 Adjustment of Agriculture to Its Environment
D-2-44 Potassium Content and Potash Requirement of Louisiana Soils
E-2-44 Plow-Sole Fertilizers Increase the Profits
F-2-44 Where Do We Stand With Fertilizers?
G-2-44 The Use of Borax in the Legume-Livestock Program of the South
H-2-44 Efficient Fertilizers for Potato Farms

THE AMERICAN POTASH INSTITUTE

1155 16TH STREET, N. W. WASHINGTON 6, D. C.

CONCRETE-ABSTRACT

A teacher was attempting to explain to the class the difference between abstract and concrete, and was doing her best to make the explanation very simple and clear. "Now," she said, "concrete is something that you can see and abstract is something that you cannot see."

A little boy looked quite enlightened, so the teacher ventured to test her explanation. "George," she said, "give me the explanation of something concrete?"

"My pants," was George's reply.

"Correct," said the teacher. "Now give me an example of something abstract?"

"Yours," gleefully shouted George.

Nurse: "Mr. Verdome, you are the father of quadruplets."

"What! Them things that run around on four legs?"

The lady on the front row had several small packages on her lap. She was also taking notes on the lecture. A package would fall and she would pick it up and continue to write. After several such occurrences, the lecturer stopped, eyed the lady, and said, "You don't seem to have enough lap." "I have enough lap," the lady replied, "but too much of it is pushed up behind."

Teacher: "Who can tell me what agriculture is?"

Thomas: "Well, it's just about the same as farming, only in farming you really do it."

'TWAS ALWAYS SO

Mrs.: "It says here that in the Sarganlas Island they sell wives for $10. Why, I think that's awful!"

Mr.: "Yep! Guess it doesn't matter where you go, you'll still find profiteers."

Guide: "We are now passing the largest brewery in the world."

Soldier: "I'm not."

VICTORY GARDENS

When the parson called on Mandy, she proudly showed him her Victory garden.

Parson: "Mighty fine garden God and you grew this summer."

Mandy: "Dat is a nice garden, if I do say so myself. But, Parson, do you remember what dat weed patch looked like last year when God had it all to Himself?"

Little Girl: "I know something I won't tell."

Daddy: "Never mind, child. You will get over that when you are a little older."

IS THAT CLEAR?

A mother who had a daughter employed in defense work in Washington wrote to ask her just what she was doing. The reply follows:

"I work in the data-analysis group of the aptitude-test sub-unit of the worker analysis section of the division of occupational analysis and manning tables of the bureau of labor utilization of the War Manpower Commission."

Need for—

BORON IN AGRICULTURE

Authorities have recognized that the depletion of Boron in soil has been reflected in limited production and poor quality of numerous field and fruit crops.

Outstanding results have been obtained with the application of Borax in specific quantities or as part of the regular fertilizer mix, improving the quality and increasing the production of alfalfa and other legumes, table beets, sugar beets, apples, etc.

The work of the State Agricultural Stations and recommendations of the County Agents are steadily increasing the recognition of the need for Boron in agriculture. We are prepared to render every practical assistance.

Borax is economical and very little is required. It is conveniently packed in 100 lb. sacks and stocks are available for prompt delivery everywhere in the United States and Canada. Address your inquiries to the nearest office.

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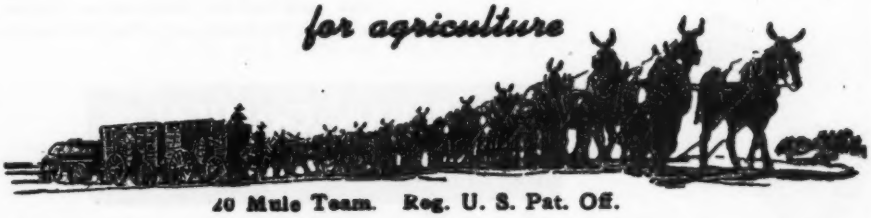
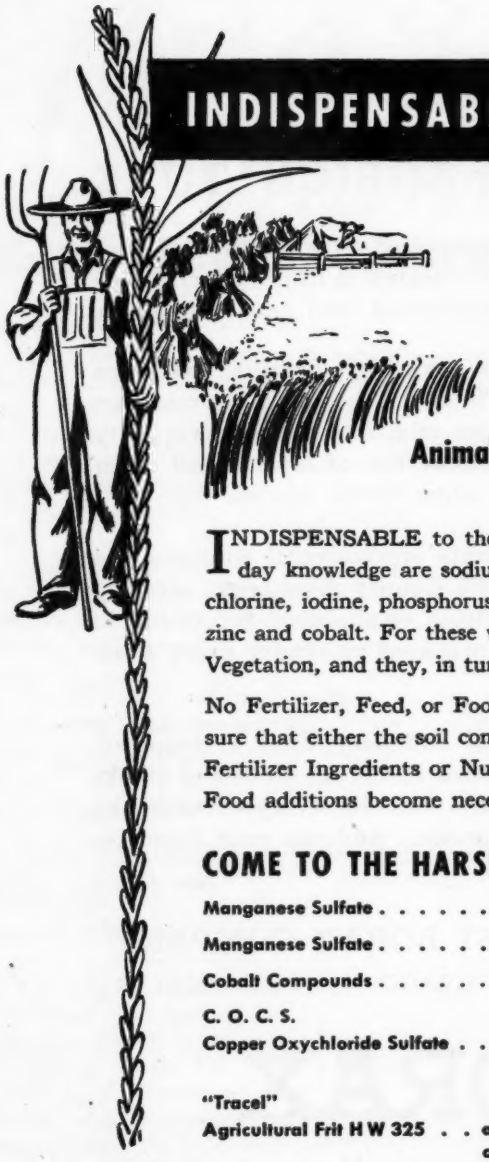


20 Mule Team. Reg. U. S. Pat. Off.

INDISPENSABLE TO ALL LIFE



37 Elements are associated in one way or another with the fabric of all life, Human, Animal, Vegetable or Micro-Organic

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